OCTOBER • 1954

PETROLEUM REFINER

REFINING | PETROCHEMICALS | NATURAL GASOLINE

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Symposium—
Cross-Graded Motor Oils

"RETAINED VOLATILITY"

You needn't lose the "Pep" in your motor fuel . . . either!

Blending with Warren NATURAL GASOLINE will give it the RETAINED VOLATILITY so necessary for superior performance after it reaches the fuel tanks of your customers.

Warren's production, transportation and storage facilities are your assurance of the quality and quantity of NATURAL GASOLINE you need . . . when and where you want it.

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3-way answer

to steam trap problems

• This three-way combination can help lick your steam trap problems.

YARWAY IMPULSE STEAM TRAP . . .
the steam trap that gets equipment *hot in a hurry and keeps it hot.* Small size, light weight, *body and all working parts of stainless steel.* Low cost, low maintenance.

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Volume 33, No. 10 October, 1954

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REFINER
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A Quick Look at This Issue

INDUSTRY PROBLEM REPORT

Industry Must Face Up to Its Problems! . . . This is the advice, always straight-talking and sometimes stern, of four top executives who were asked:

- What is really the situation as regards refining capacity and the market for refined products?
- Is the inventory situation serious, or are the figures misleading?
- What is the outlook for refining capacity?

The answers to these questions, so vital to the well-being of the industry, were supplied by:

- Bruce K. Brown, president, Pan-Am Southern Corporation, New Orleans.
- John W. Newton, vice president and manager-refining, Magnolia Petroleum Company, Beaumont.
- R. L. Tollett, president, Cosden Petroleum Corporation, Big Spring, Texas.
- M. Halpern, senior vice president, The Texas Company, New York.

The present difficulty, they agreed, is nothing more than one of those occasional rocky stretches to be found in the sometimes devious highway of free enterprise.

But what of cause and cure?

Here there was less harmony.

For one of the most penetrating analyses ever published of the problems besetting our industry, turn now to **Page 96.**

CROSS-GRADED MOTOR OILS SYMPOSIUM

GASOLINE is not the only product in for a "new look" because of the high compression ratio engine developments. Hot on the heels of the additive controversy is the subject of cross-graded or multiple viscosity motor oils. Anticipating the new engine developments, the refining industry has devoted considerable attention to the manner in which selection and compounding of lubricating oils stocks affect the fuel requirements of engines. The big questions about the new oils are: do they save gasoline? do they reduce deposits and do they protect engines? In the three articles in this symposium, you will find answers to these questions according to the research programs of three leading companies.

- **How 10W-30 Motor Oil Performs . . .** The authors claim this blend has superior combustion chamber deposit properties, satisfactory oil consumption characteristics, and maintains its viscosity and high viscosity index for normal periods. Further, the

→ Turn Page →

beneficial effects of multiple graded motor oils will contribute to more satisfactory operation of high compression cars operating on the fuels available today. **Page 99.**

• **How Good Are the "New" Motor Oils? . . .** According to this author, they can be good, but not so good that a "new era" in engine lubrication has been introduced. Although the multi-viscosity volatile type oils can produce limited improvements in fuel consumption, it's doubtful if the motoring public will be able to detect significant benefits, because of the much greater effects of driving conditions on fuel consumption. **Page 104.**

• **Designing Performance into Motor Oil . . .** The authors claim that oil quality can best be achieved by concentrating attention on the performance requirements of the gasoline engines now in service and to be built. Arbitrary classifications or specifications which impose undesirable limitations should be disregarded. **Page 110.**

Field Welding Heavy Wall Vessels . . . Field welding of heavy wall pressure vessels poses many problems which do not exist in the case of shop welding similar vessels. The author, from experience gained in the field welding of vessels up to five inches thick, offers solutions to these problems and outlines some precautionary measures. **Page 117.**

New Viscometer Solves Old Problem . . . The old problem of measuring viscosities in fundamental units has been solved with Atlantic's new viscometer. Thoroughly tested in both laboratory and field, the new instrument has been accepted by the ASTM's Committee D-2. It is accurate, easy to manipulate, and is sturdy enough to reduce breakage to a minimum. **Page 121.**

Sea Water as an Industrial Coolant, Part I . . . Cooling with sea water can be both a blessing and a curse. Coastal refineries and chemical plants are lucky to have such an ample source of water; but without an understanding of the operating conditions involved with this medium, some bad corrosion problems will develop. Dow's ten years experience with sea water at Freeport has shown that these problems can be solved. **Page 127.**

Understanding the Chemistry of Petrochemical Reactions, Part 17 . . . With this part on the preparation and properties of the acetylenes, we are concluding the current series by Dr. Hatch. Here is a discussion of the production of acetylene by the calcium carbide process and by the three processes utilizing natural gas—Wulff, Schoch and Sachsse. The properties of the acetylenes are also covered as well as a description of the chemistry of the acetylene based on work by Dr. Reppe. For more on this subject, see **Page 131.**

New Catalyst Recovery Device . . . Used to recover usable Hydroformer catalyst, this device yielded a 500 percent return for the designers. Based on a size-density separation technique well-known in the chemical industry, the design offers considerable potential for refining application. The value of the article is further enhanced by the important correlations, never before published, on the relationships between catalyst surface area and age, crushing strength versus surface area, and bulk density versus crushing strength. For a valuable process that may be adaptable to your own operations, turn to **Page 137.**

Maintenance Reorganization Pays Off . . . In overall maintenance efficiency improvements of 12-20 percent. Here's the story of how one large refinery instituted a field coordinating supervisory organization to achieve a more efficient utilization of maintenance men, materials, and tools. **Page 141.**

The Economics of Softening Cooling Water . . . The author claims we are 30 years behind the times in our methods of treating process unit cooling water. Then he proceeds to work out a set of economics to back up his point. His economics indicate a payout of something less than 4 years for complete treating of all cooling water. Regardless of what your present views may be on the problem, you will profit from a study of this unusual presentation. **Page 145.**

How to Maintain Compressors . . . This plant operator reduced compressor downtime from a previous average of 4.7 percent to a new low of 1.04 percent. In this article, his secrets are revealed, complete with photos of several special items of equipment that were developed to speed maintenance work. A real "how-to" contribution, we predict that this article will put real profit dollars in readers' pockets. **Page 147.**

The Design of Hyperforming Units . . . Of ever-increasing importance to refiners is the upgrading of naphthas, and one of the latest commercial processes is Hyperforming, which incorporates a number of new mechanical features. Here is an engineering analysis of the new process presenting a review of its mechanical features and a discussion of its general field of application. *Must* reading for process and design engineers and managers. **Page 153.**

Three Ways to Shed the Detail Problem . . . Every executive has available to him three means by which he can lighten the burden of routine. You can delegate. You can select. You can streamline. Turn to **Page 97** and let Auren Uris give you some time-saving, money-saving hints on how to throw off detail.

How to Start an Employe Publication . . . Last month the author told you how to determine whether you really need an employe publication. Now he tells you in step-by-step fashion how to get the job done. For some real, money-saving help on how to solve a problem which every expanding plant must face sooner or later, turn to **Page 231.**

The New Tax Law—Challenge to Business . . . The new internal revenue code is not only a challenge to business; it's loaded with employe concessions. See that they know about the new injury and sick benefits, favorable treatment for stock options, and the liberalized rule on transportation costs. **Page 242.**

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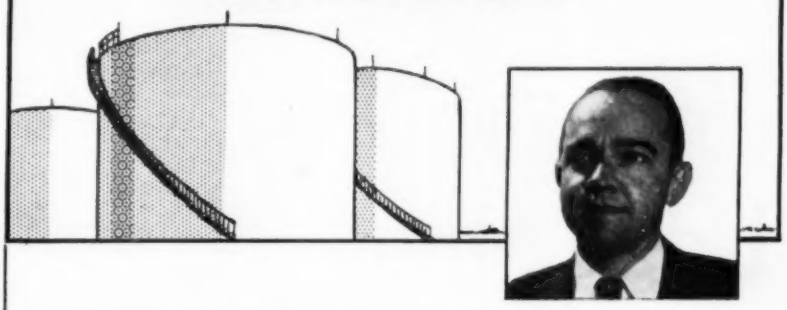


Hands Across the Sea. We do considerable head-scratching from time to time on how we can best serve our foreign subscribers. They represent a lusty hunk of our readers (about 18 percent) and we know that they subscribe to REFINER chiefly because they are interested in American technological developments. But still it seems that they should get some sort of special treatment. We've a few ideas cooking that are predicated on the feeling that U. S. subscribers are also mighty interested in what is going on in the rest of the world. Who knows—you might find yourself working there! A friend of mine is now doing his engineering at a refinery in India, when six months ago he didn't even know India had one.

Our non-U. S. subscribers are good readers as evidenced by the letters we get from them. These letters are always tremendously interesting, not because of the difficulties they have with the English language, but because of their writers' deep-seated humility and courtesy. Here is an excerpt from one that accompanied a very well written manuscript:

"With both delightfulness and timidness I write this letter to you. With delightfulness since I shall write this letter to the most distinguishing and consulting petroleum engineers in the world who were early recognized with respect and esteem in their journal 'Petroleum REFINER.' With timidness since I shall audaciously deliver this manuscript to your journal.

"I am a chemical engineering in Kaohsiung Refinery, Taiwan, Free China. Eight years ago after graduated my mother college, National Central University in Nanking, I came to Kaohsiung Refinery working up to date . . ."

(signed) 趙 藻 澄
(Y. C. Chao)

Now isn't that a wonderful letter? Perhaps the calloused American business man, under constant pressure to keep his business messages concise, is losing a great opportunity to be sociable and friendly.

No Brand Names in Articles is a stern and inflexible rule with REFINER and causes all sorts of beefing both from authors and manufacturers. Like all inflexible rules, very often exceptions seem warranted but we can't let the gate down without danger of the herd stampeding through. We have this rule for several reasons: first, the feature articles are not intended to promote any one brand of equipment, directly or indirectly. Second, we couldn't, in fairness, allow one brand to be mentioned without giving equal space to other brands of the same item and obviously that would be quite a chore. Every now and then we lose a good article because of this policy but we try to miss no bets, since we can always give new types of equipment adequate recognition in our New Equipment Section.

What's the World Coming To Dept. There's been considerable breast-beating and wailing among parents that the new fangled methods of school teaching aren't properly educating our children and maybe they're right. Last week when I was calling on the refinery of a major oil company, the sweet young receptionist asked me the name of our magazine so she could make out my pass. Then came the clincher from this oil company steno: "How do you spell "*Petroleum*"? Heavens-to-Betsy!

—Bob Phillips

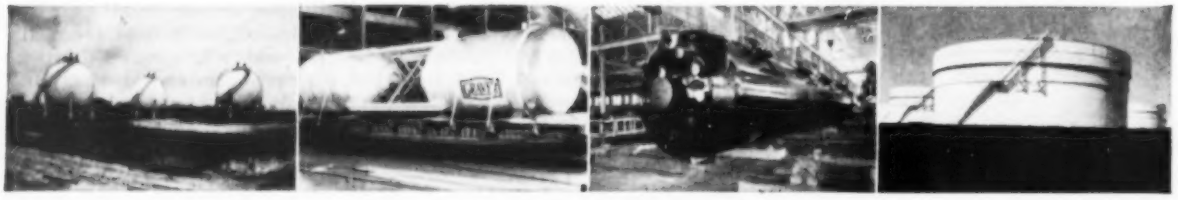
New GRAVER Edge Moor Plant

...occupying 25 acres at Edge Moor, Delaware (adjacent to Wilmington) for the manufacture

of towers pressure vessels

...eastern headquarters for field-erected tankage

and exclusive GRAVER conservation designs



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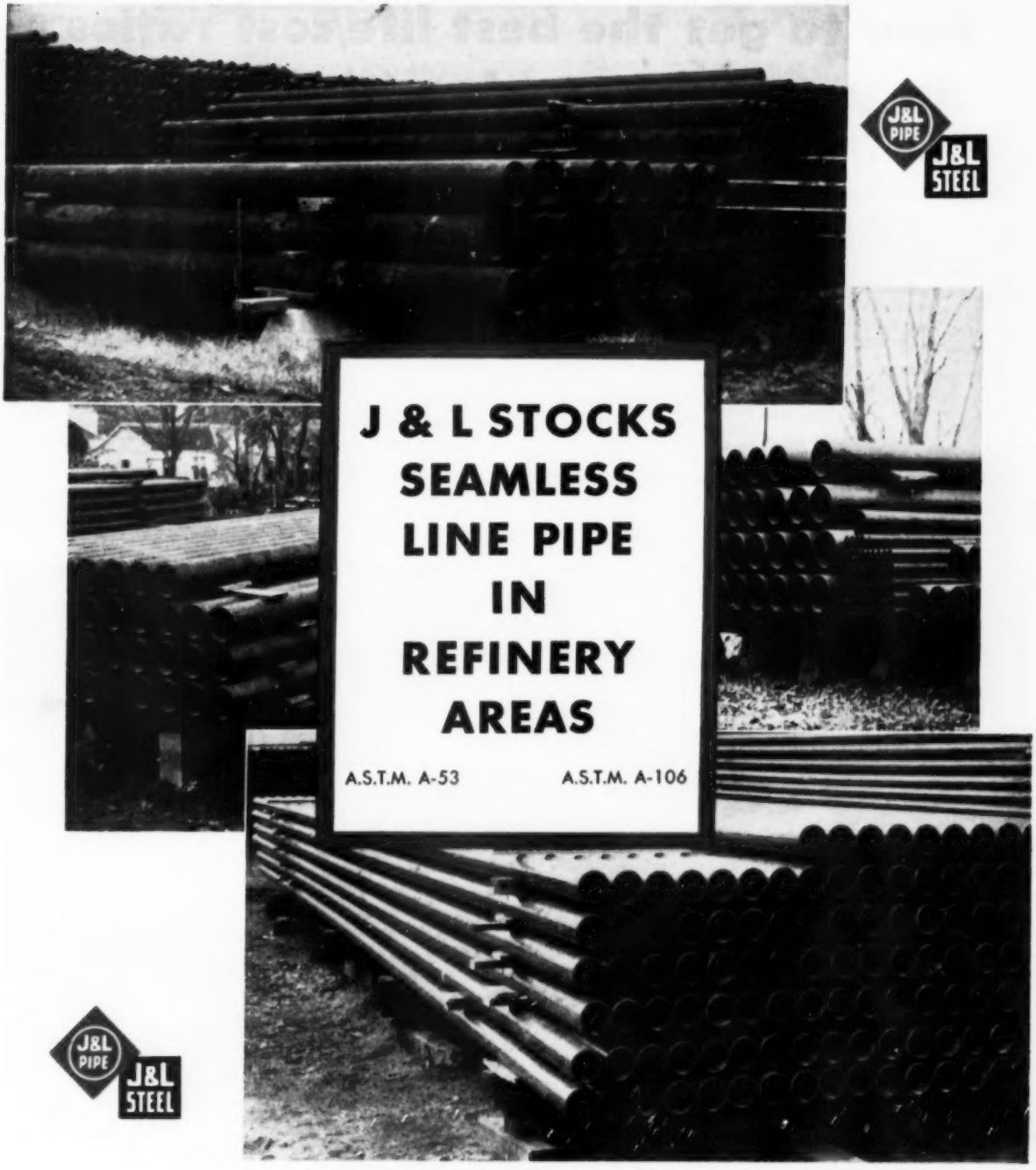
GRAVER ...tank fabricators for 97 years



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"...here's MY warehouse!"

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SUPPLY DIVISION

Serving The United States and Canada
General Offices: Tulsa, Oklahoma
J&L Tubular Products and Wire Rope

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For more data on advertised products, use Readers' Service Cards, last page.

How to get the best life/cost ratios in your tube steels: *Ask the experts!*

This month's report is on: **18-8 STAINLESS**

An austenitic, non-magnetic alloy that shows the best combination of creep strength, oil corrosion resistance and oxidation resistance for service up to 1500°F. For use in oil cracking systems, hydrogenation equipment, high temperature oil and steam piping, superheater elements, heat exchangers.

ONE OF 24 TIMKEN HIGH TEMPERATURE STEELS

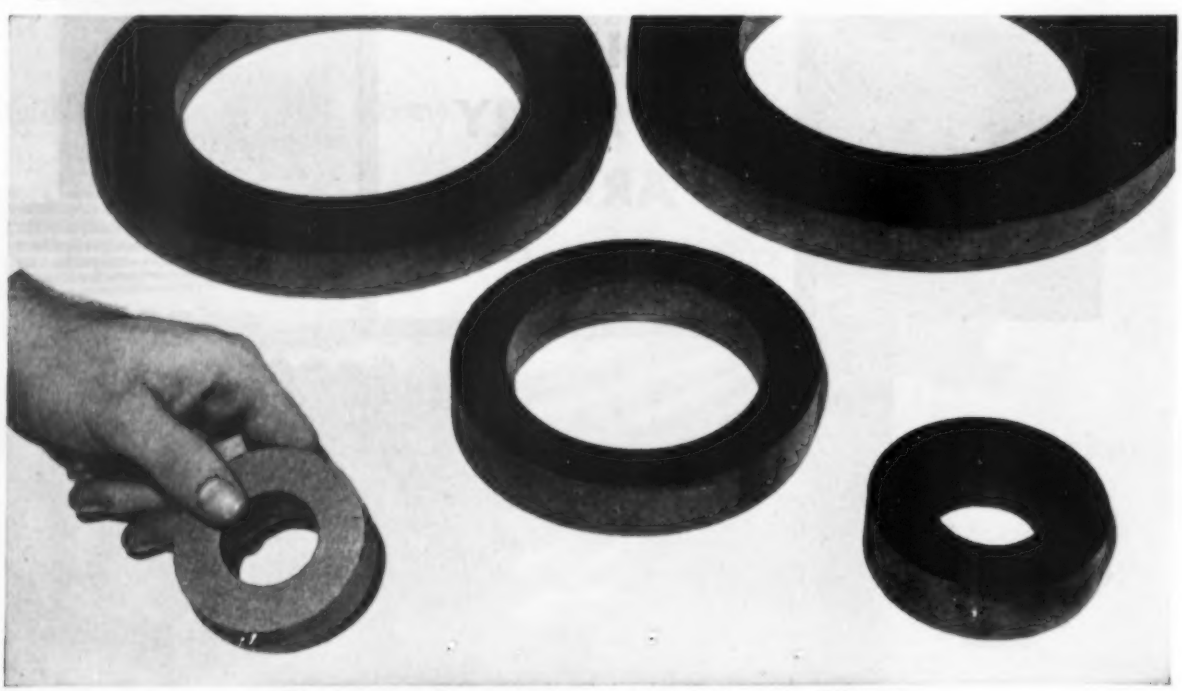
Carbon	Sicromo 2	Sicromo 9S	18-8Ti
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	16-13-3
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-20*
Silmo	Sicromo 3	Sicromo 9M	25-12*
DM	4-6% Cr.-Mo.	18-8 Stainless	35-15**
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	16-25-6**

* *Available as seamless tubing on an experimental basis only.*
** *Not available as seamless tubing.*

PROBABLY you can find several high temperature tube steels that will solve your heat, pressure, corrosion or oxidation problems. But, there's only one that will give you maximum tube life per dollar—the best life/cost ratio.

Give Timken company metallurgists the problem of finding this steel for you. They're the experts. With years of steel research and experience, they can help you select *your* best steel from 24 different analyses. You'll be sure of getting the tube steel with the best life/cost ratio. And regardless of which analysis you select, you'll be assured of uniform quality because the Timken Company rigidly controls quality from melt shop through final inspection.

Got a tube problem? *Ask the experts!* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Timken heavy-wall pressure tubing is available in sizes up to 10½" O.D.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

3 grades of Aerocat® FLUID CRACKING CATALYST

for better fluidizing, circulating and attrition characteristics

in any fluid cracking unit

The importance of particle size distribution in catalyst efficiency is reflected in the names and performance of Cyanamid's three new grades of AEROCAT.

Following extensive research into existing fluid cracking unit needs, these grades were developed to cover the entire range of requirements. Now you can readily select the grade best suited to your unit operation and secure a higher degree of catalyst utilization through proper fluidization, circulation and reduced attrition. These grades represent a wide range, identified for your convenience by their Particle Distribution Index.

This is another advance in catalyst development that makes AEROCAT your most economical means to

- high octane yields
- high throughput
- low CO_2/CO ratio in flue gas
- high isobutane yield
- excellent heat, steam and sulfur stability

– all good reasons why 8 out of 10 users of synthetic catalyst specify AEROCAT Fluid Cracking Catalyst.

For details, write for a new technical data sheet "AEROCAT–Particle Size Distribution," or discuss your needs with our Technical Representative.

DESIGNED TO MEET ALL FLUID UNIT NEEDS

Aerocat 50/60 (Light) — for fluid units with low linear gas velocities, adequate dust disengaging space, excellent cyclone and Cottrell efficiency, low bed density needs.

Aerocat 60/70 (Intermediate) — for fluid units with moderate to high linear gas velocities, adequate catalyst recovery equipment.

Aerocat 75/85 (Narrow) — for fluid units with high linear gas velocities, moderate disengaging space, limited recovery equipment.

Aerocat® Fluid Cracking Catalyst

AMERICAN Cyanamid COMPANY

REFINERY CHEMICALS DEPARTMENT

30 Rockefeller Plaza, New York 20, N. Y.

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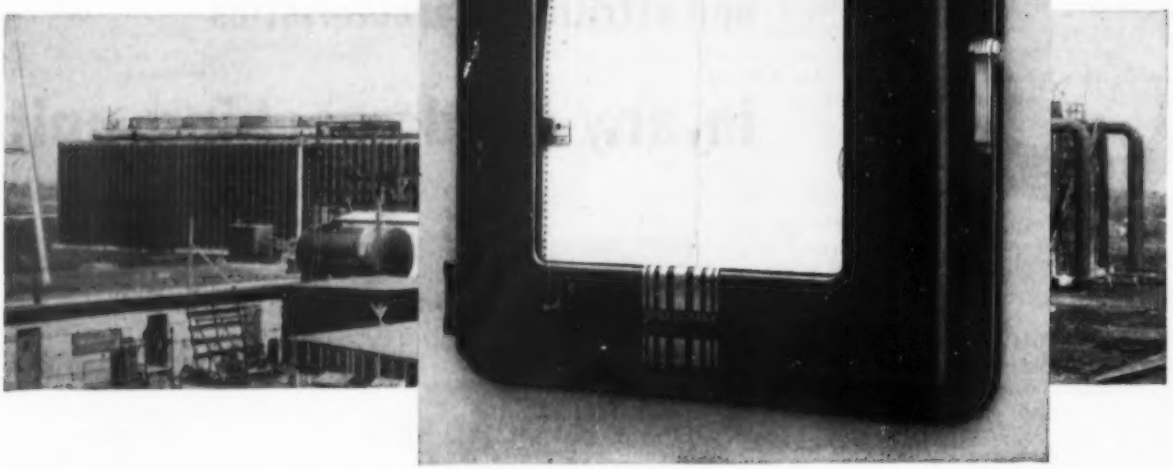
For more data on advertised products, use Readers' Service Cards, last page.

Here is the panel-mounted Speedomax instrument which records and controls pH of cooling water in the towers at KG&E's Murray Gill Station. The actual record shows pH being controlled within ±0.1pH.



pH is no problem

IN THIS COOLING TOWER

The once troublesome problem of effectively controlling the pH of cooling tower water has been solved in the towers at the Murray Gill and Ripley Stations of Kansas Gas and Electric Company.

Various other control arrangements, on similar tower systems, have been tried . . . with varying degrees of success. But the present system at KG&E demonstrates that, with the application of L&N's Controllability Analysis and practical engineering principles, a cooling tower system can work *for*, rather than *against*, full-function control of pH.

The benefits of effective pH control are readily apparent at KG&E. According to a report from the company's Production Department, they include "conserving large amounts of make-up water, wood protection, prevention of carbonate scale, and more effective slime control." The report adds that "automatic pH control at both plants has been effective and satisfactory."

We'll be glad to discuss your cooling tower pH control questions with you. Write for Process Data Sheet 700(1) which explains "L&N pH Control of Cooling Tower Water." With it, you'll receive a Controllability Analysis Questionnaire which will help us to analyze the controllability factors of your towers. Fill out the Questionnaire and return it, without obligation, to Leeds & Northrup Co., 4923 Stenton Ave., Philadelphia 44, Pa.

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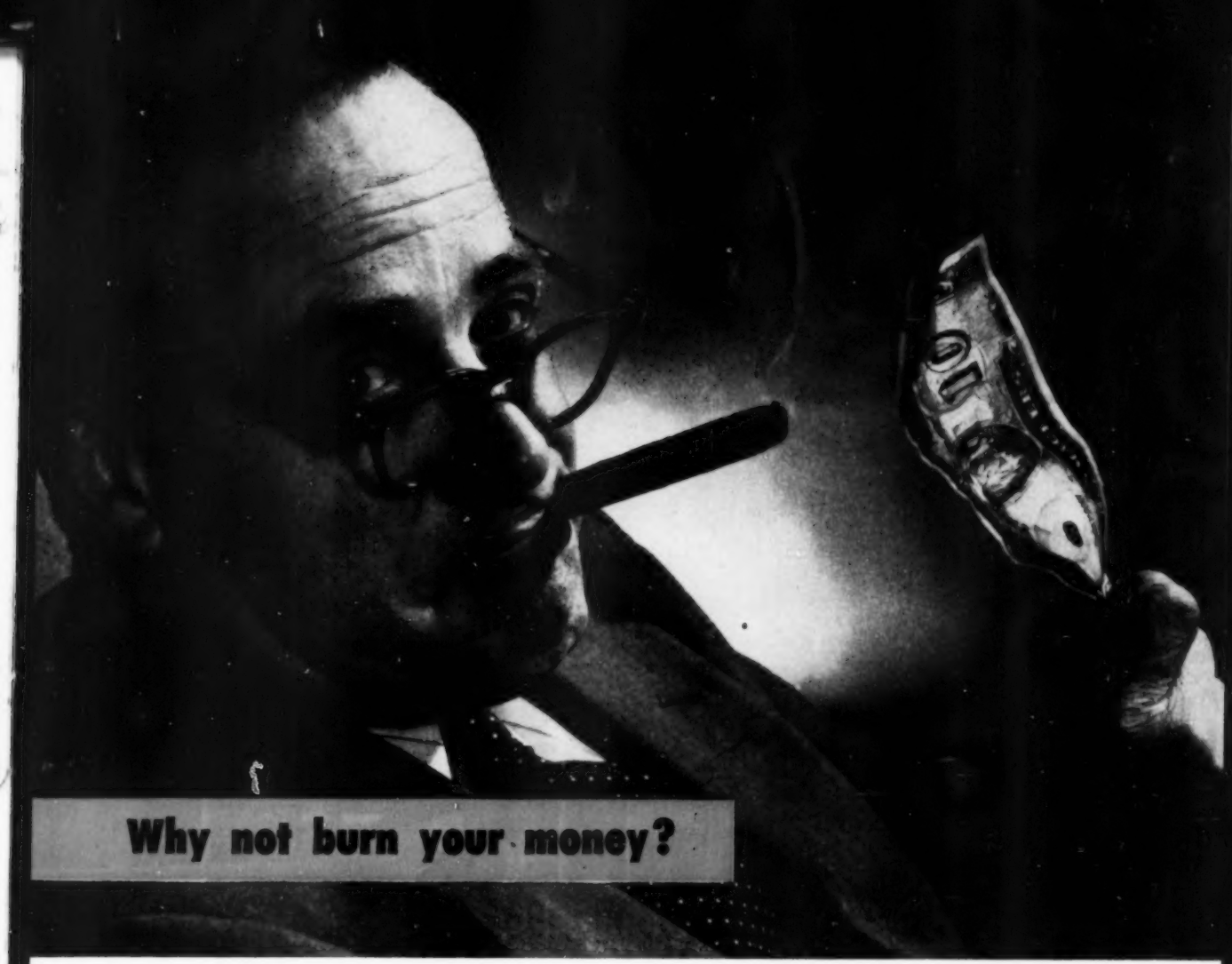
instruments *automatic controls* • *furnaces*



Why not burn your money?

● You might as well . . . if you don't get everything your dollar will buy.

At "Oilwell" *you get full value for every dollar*. Our completely stocked and strategically located warehouses serve as your own stores department. Service is always prompt—and you are saved the cost of maintaining large inventories.

In addition, you enjoy the many advantages that go with buying from a single source of supply . . . time saved in placing orders, everything delivered together, reduced receiving details, simplified accounting.

Read this list of benefits—yours when you buy from "Oilwell."

Lower inventory investments—You can cut your own warehouse stocks to a minimum, reduce obsolescence and get a wider selection of materials, sizes and brand names from "Oilwell's" complete inventories.

Quality products—"Oilwell" stocks include the best known brand names in equipment and materials designed and approved for refinery operations. When it comes from "Oilwell," you know it will meet your specifications.

Complete warehouse system—Well-stocked warehouses are conveniently located to serve the important refining centers. Inquiries are given prompt attention and deliveries are made quickly to meet your emergency requirements.

Experienced personnel—"Oilwell" refinery specialists, having been trained in refining and petrochemical plants, understand your material and service problems and can give you the service you require.

92 years of experience—From almost the beginning of the petroleum industry, "Oilwell" has worked with the men engaged in drilling and production. Our goal is to extend the same prompt, dependable and complete service to those responsible for Refining and Petrochemical operations.

These famous products are sold by "Oilwell"

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Vogt
Walworth
Watson-Stillman
Wilson-Snyder
Worcester

and many others

OIL WELL SUPPLY

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Borger, Texas · **Los Angeles, California**
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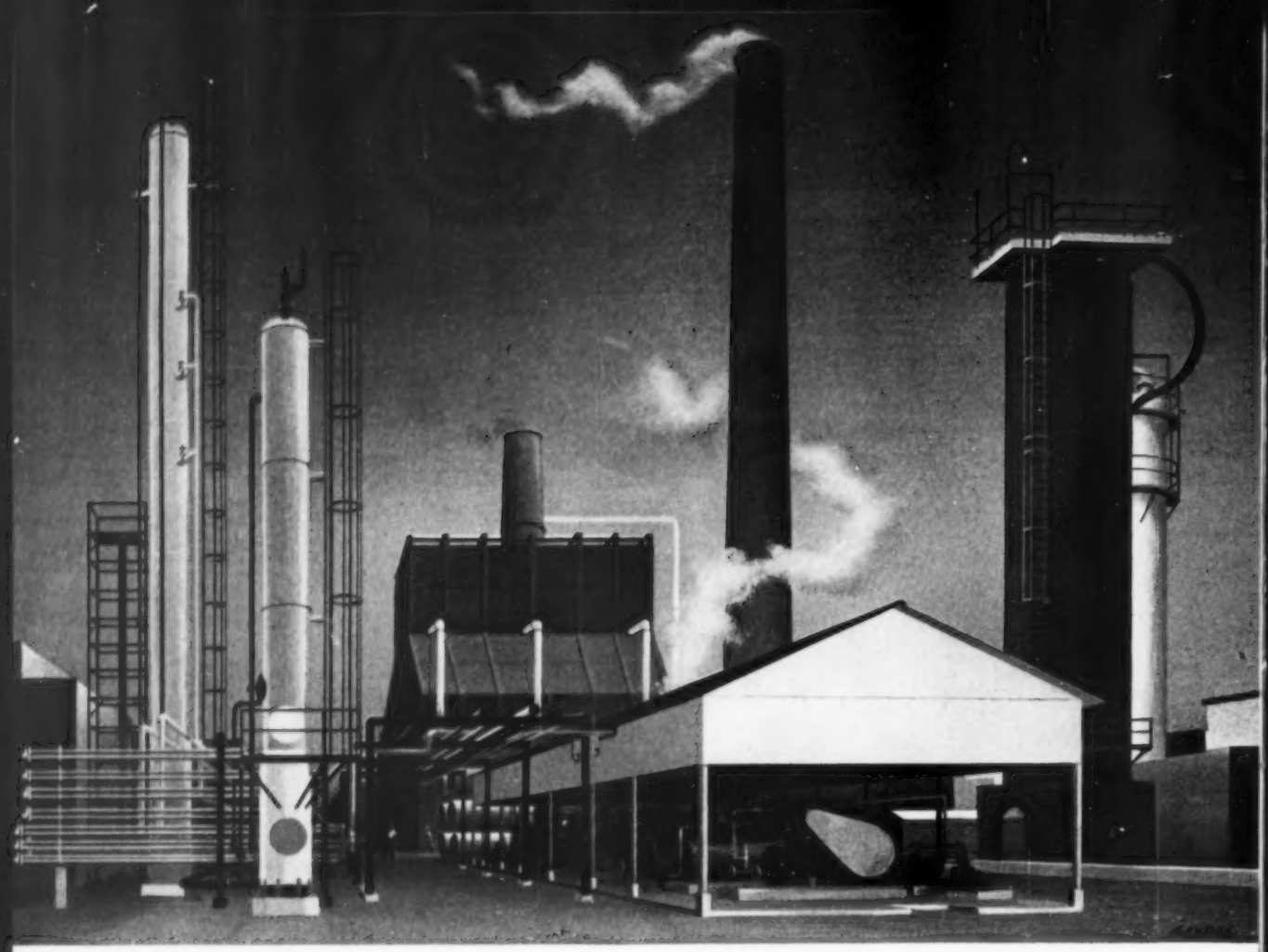
USS

Branches Serving All Oil Fields

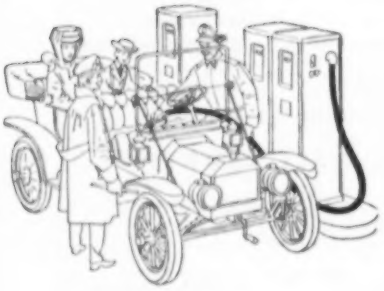
"OILWELL"

TRADE MARK

UNITED STATES STEEL



upgrading "model T" fuels into high octane gasoline



Satisfying the thirst of millions of high compression automobile engines is becoming more and more of a headache to America's refiners.

In 1953, nearly 44 million motorists consumed almost 14 billion gallons of high octane gasoline. These premium fuels represent a mere 13 percent, or less, of the total amount of petroleum products normally processed from crude oils.

The problem: how to squeeze a higher percentage of this high-test gasoline from petroleum.

One solution lies in a process known as catalytic reforming, which applies a combination of chemical treatments to increase the yield of high octane gasoline from the tremendous surplus of less valuable, low grade fuels. For many refiners, catalytic reforming of these "model T" fuels is the difference between profit and loss.

Building plants which enable refiners to profitably recover high octane gasoline from marginal fuels is but one of many Blaw-Knox activities.

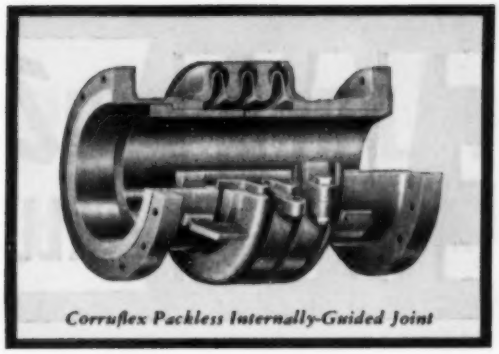
Blaw-Knox designs and constructs many types of process units to meet the refiner's everchanging product distribution and quality requirements including distillation, cracking, reforming, coking, polymerization, solvent treating and hydrogenation.

BLAW-KNOX

BLAW-KNOX COMPANY

Chemical Plants Division / Tulsa 1, Oklahoma

Pittsburgh 22, Pennsylvania / Chicago 1, Illinois

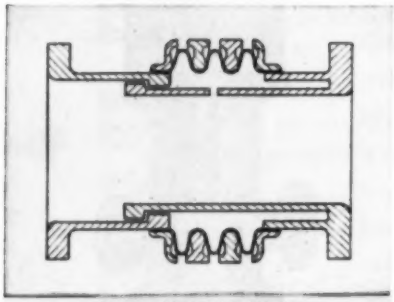


Corruflex Packless Internally-Guided Joint

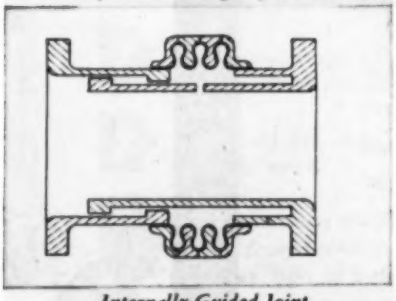
RIGID

AGAINST ALL MOTION EXCEPT AXIAL . . . .

THE *Corruflex* INTERNALLY-GUIDED JOINT



Internally-Guided Joint Before Absorbing Expansion



Internally-Guided Joint After Absorbing Expansion

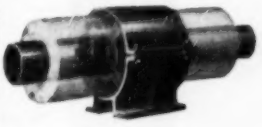
One of many reasons why Corruflex Packless Expansion Joints are so widely used by progressive engineers is the completeness of the Corruflex line. There is a Corruflex joint to absorb pipe expansion under *any* piping condition.

Suppose an engineer wants a joint which provides rigid construction against all movement except axial movement. ADSCO has the perfect solution — the Corruflex Internally-Guided Expansion Joint. No maintenance required because it is packless. Joint is built with an internal sleeve of heavy wall construction for effective guiding. Inner end of sleeve has a guide ring riding on a machined bore to insure true axial movement. Limit stop prevents the joint from being extended beyond its predetermined limit.

ADSCO makes the most complete line of expansion joints of any manufacturer in the world. That means complete engineering! Come to ADSCO for the *right* joint.

Don't let pipes get out of line

Use ADSCO Alignment Guides with ADSCO Expansion Joints. Cylinder is 12" long in all sizes, permitting pipe movement of 10". Damage to insulation prevented by ample clearance between guiding cylinder and pipe.



ADSCO ENGINEERED PRODUCTS

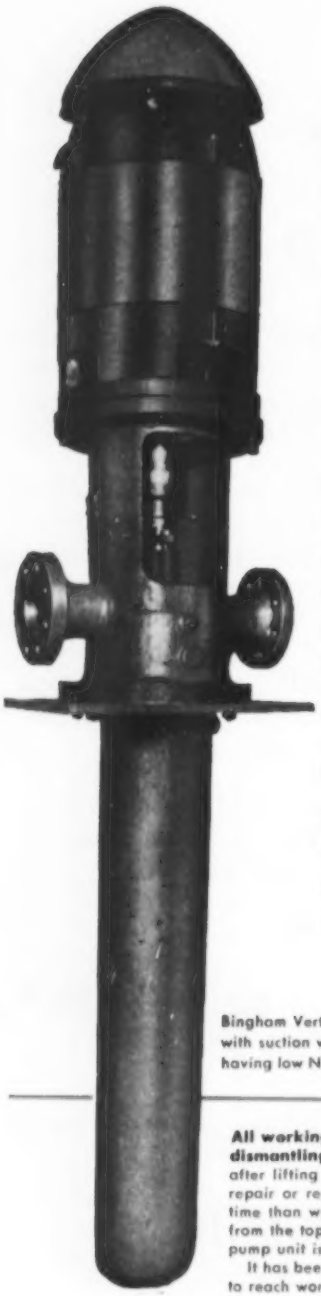
EXPANSION JOINTS • HEAT EXCHANGERS • STEAM TRAPS • STRAINERS • SEPARATORS • METERS

AMERICAN DISTRICT STEAM COMPANY, INC.

GENERAL OFFICES
NORTH TONAWANDA, NEW YORK
PLANTS: NORTH TONAWANDA, N. Y., AND RICHMOND, CALIF.

For more data on advertised products, use Readers' Service Cards, last page.

NEW! Bingham ALL WORKING PARTS

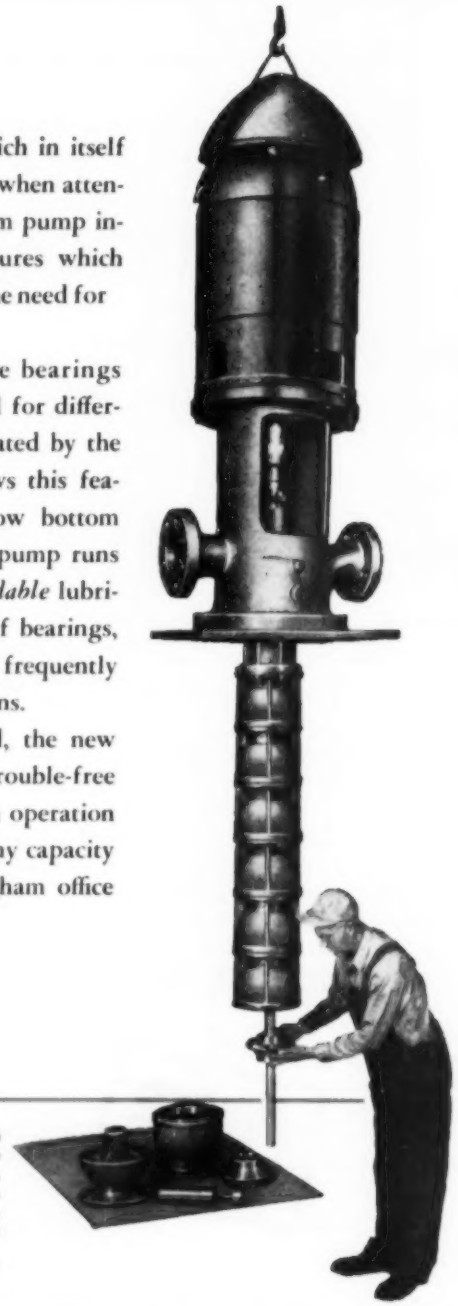


Bingham Vertical VCP assembled with suction well for installations having low NPSH conditions.

Besides bottom dismantling, which in itself greatly reduces maintenance time when attention is required, this new Bingham pump incorporates advanced design features which minimize maintenance, reducing the need for periodic inspection.

For example, all intermediate bearings (supplied of appropriate material for different pumpages) are forced-lubricated by the pumpage. Diagram at right shows this feature and, in addition, shows how bottom bearing is lubricated even if the pump runs dry for short periods. This *dependable* lubrication greatly prolongs the life of bearings, which in conventional pumps are frequently the cause of maintenance shutdowns.

Wherever it has been installed, the new Bingham VCP Pump has given trouble-free service—plus unsurpassed smooth operation with no vibration. Available for any capacity or head. Write your nearest Bingham office for additional information.



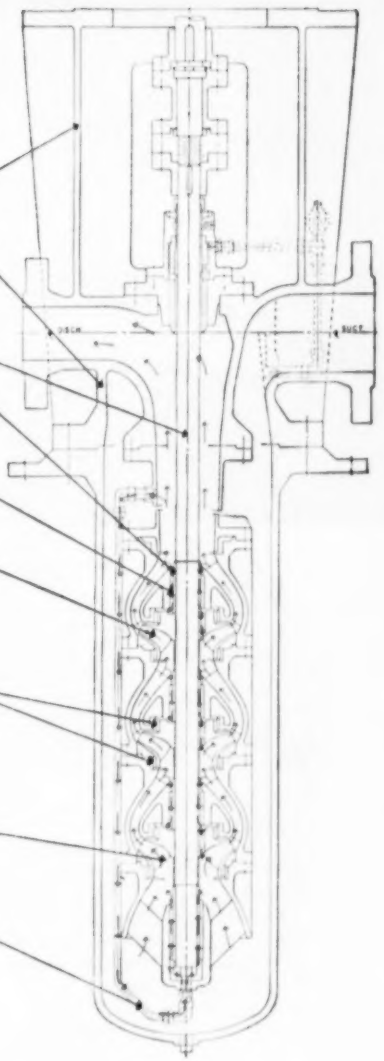
All working parts of pump easily accessible with bottom dismantling. One man can service the Bingham VCP Pump after lifting pump from well. By dismantling from the bottom, repair or replacement of any part can be made in much less time than with conventional pumps (where dismantling begins from the top, necessitating removal of driver and head before pump unit is accessible).

It has been estimated by various operators that time required to reach working parts has been reduced as much as 50%.

VCP VERTICAL PUMP FOR LOW NPSH
ACCESSIBLE WITH BOTTOM DISMANTLING

ONLY *Bingham* OFFERS ALL THESE BENEFITS:

1. Heavy-duty steel suction and discharge head rigidly built to eliminate vibration caused by drivers.
2. Shaft is maximum diameter throughout.
3. Shafts are equipped with renewable 11-13 chrome, hardened, ground and polished sleeves at each bearing.
4. Bearings are of the appropriate material for the different pumpages.
5. Maximum head per stage and maximum efficiency for a given capacity range.
6. Front and back wearing rings on enclosed type impellers permit a one-stage pressure drop over each bearing for lubrication purposes.
7. Wear rings reduce thrust of rotating element, permitting use of standard motors.
8. Maximum eye area of bottom impeller for lowest possible NPSH.
9. Bottom bearing lubricated by pumpage taken from the discharge column, which, together with connecting pipe, acts as a reservoir for bearing lubrication in event pump operates "dry" for short periods.



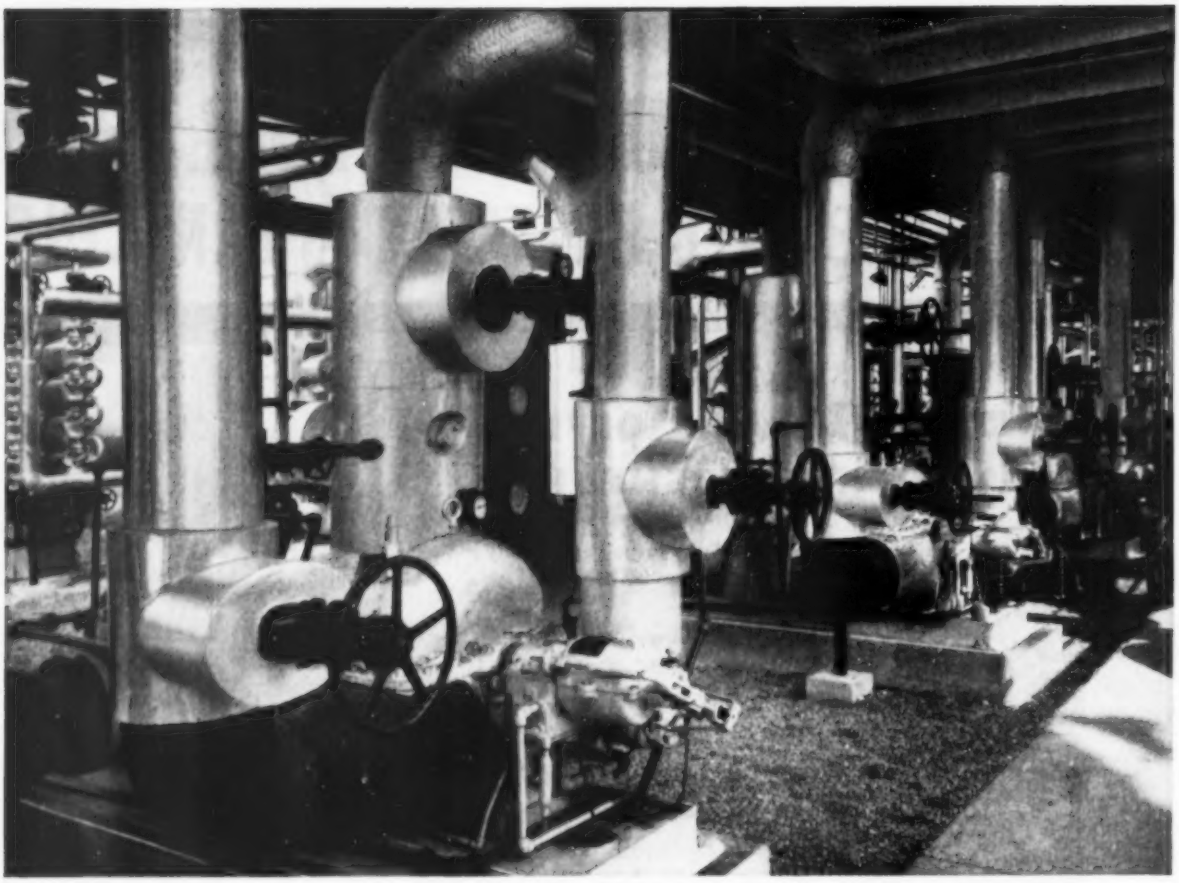
Bingham SINCE 1921 — DOUBLE VOLUTE RADIAL BALANCE PUMPS

BINGHAM PUMP COMPANY
General Offices: **2800 N.W. Front Avenue, Portland 10, Oregon**
Factories: **Portland, Ore. • Vancouver, B.C., Canada**

SALES AND SERVICE OFFICES

BOSTON, MASS.	SAN FRANCISCO, CALIF.
CHICAGO, ILL.	SEATTLE, WASH.
DENVER, COLO.	ST. LOUIS, MO.
HOUSTON, TEXAS	ST. PAUL, MINN.
KANSAS CITY, MO.	TULSA, OKLA.
NEW YORK CITY, N.Y.	TORONTO, ONT., CAN.
PITTSBURGH, PA.	VANCOUVER, B.C., CAN.

For more data on advertised products, use Readers' Service Cards, last page.



POWER FOR DRIVING PROCESS PUMPS *plus* high-pressure exhaust steam is double benefit provided by four Worthington single-stage turbines at Ohio Oil Co., Markham, Texas.

Stay on stream...

with Worthington single-stage turbines

The Ohio Oil Company in Markham, Texas, needed drives for a group of four pumps used in the absorption, distillation and fractionating of natural gas.

Problem was, what kind of drive? This didn't remain a problem long — not after we laid out the facts on Worthington single-stage steam turbines. Ohio Oil settled fast on these job-proved units.

Now they're not only getting dependable power out of these turbines, they're also getting exhaust steam at 90 psig to use in their distillation process.

They picked Worthington single-stage turbines because these units had a reputation for doing a fine job. These turbines were selected from a complete range of frame sizes, available to meet the requirements of any single-stage turbine application.

If you'd like to know more about our steam turbines, the first step is to write Worthington Corporation, Harrison, New Jersey, for Bulletin 1953C.

T.4.4

SEE the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street.

WORTHINGTON

STEAM TURBINES

Single- and Multi-Stage Turbines • Turbine-Generators • Deaerators • Boiler Feed Pumps • Surface Condensers

A GREAT TEAM IN STEAM

TAKE OUT THE SALT

AND THE RISK...

with **Visco**

DESALTING TREATMENT

● Visco Desalting Treatments are your assurance of maximum salt removal and minimum risk of deposits, or plugged equipment. Used alone, or with electrical desalting, Visco formulas consistently and economically produce low salt content crude.

Your Visco Representative will be available whenever you call. Ask for his recommendations for better operation and lower treating cost. For fastest action call collect to Houston, Madison 0433, today.

VISCO PRODUCTS COMPANY
INCORPORATED
2600 Nottingham at Kirby
Houston 5, Texas

Visco®... CONSISTENTLY EFFICIENT OIL INDUSTRY CHEMICALS

"Featherweight" 85% Magnesia was installed on the ducts, housings and lines of these "making" machines in the plant of Behr-Manning Corporation, a division of Norton Company. Insulation contractor—Armstrong Cork Company.

Heat saved . . . Money saved with K&M high temperature insulations

K&M insulations keep costs down by holding heat losses to an absolute minimum. You can always count on dependable "Featherweight" 85% Magnesia Insulation to provide exceptionally efficient heat conservation.

Made of 85% basic carbonate of Magnesia and asbestos fiber, "Featherweight" 85% Magnesia effectively insulates piping and equipment with temperatures up to 600°F. Used with K&M Hy-Temp insulation, its range is extended to 1900°F. This insulation combination lasts the life of the equipment it serves, withstands moisture, vibration and frequent temperature change.

New and now available is "Featherweight" Water-Resistant Magnesia insulation for temperatures up to 450°F. It is used underground where severe water exposure may damage the insulation or on indoor steam heated lines and equipment where high humidity and moisture are present.

Your K&M distributor is an experienced applicator who will gladly give you details about these money-saving insulations. Or write directly to us.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

Nature made asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

K&M Best in asbestos

Dependable

Struthers Wells

MIXING EQUIPMENT

A complete line of Mixers designed for handling everything from the

THINNEST LIQUIDS to the THICKEST DOUGHS

Struthers Wells builds a complete line of Mixing Equipment for every purpose, including liquid agitators, hydrogenators, kneading machines and intensive mixers. Our extensive machine shops, plate fabricating facilities, forging equipment—combined with years of experience in the design of Mixing Equipment make Struthers Wells one of the foremost suppliers of this type of equipment.

LIQUID AGITATOR

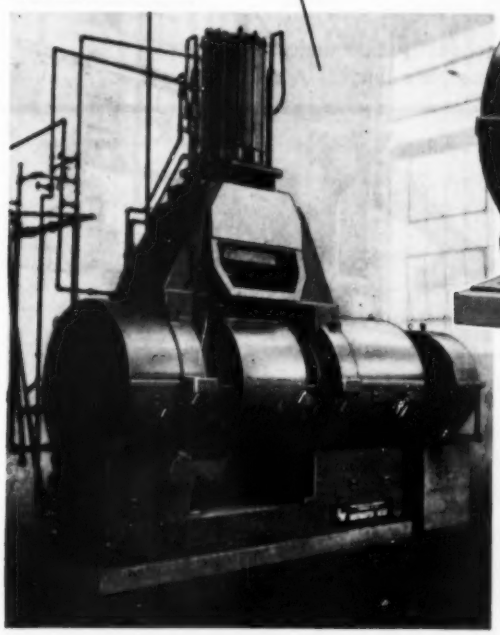
Equipped with patented Radial Propellers is suitable for hydrogenation and mixing a wide range of liquids. Any materials that will flow while being mixed can be handled under vacuum, low or high pressure with heating and cooling when required.

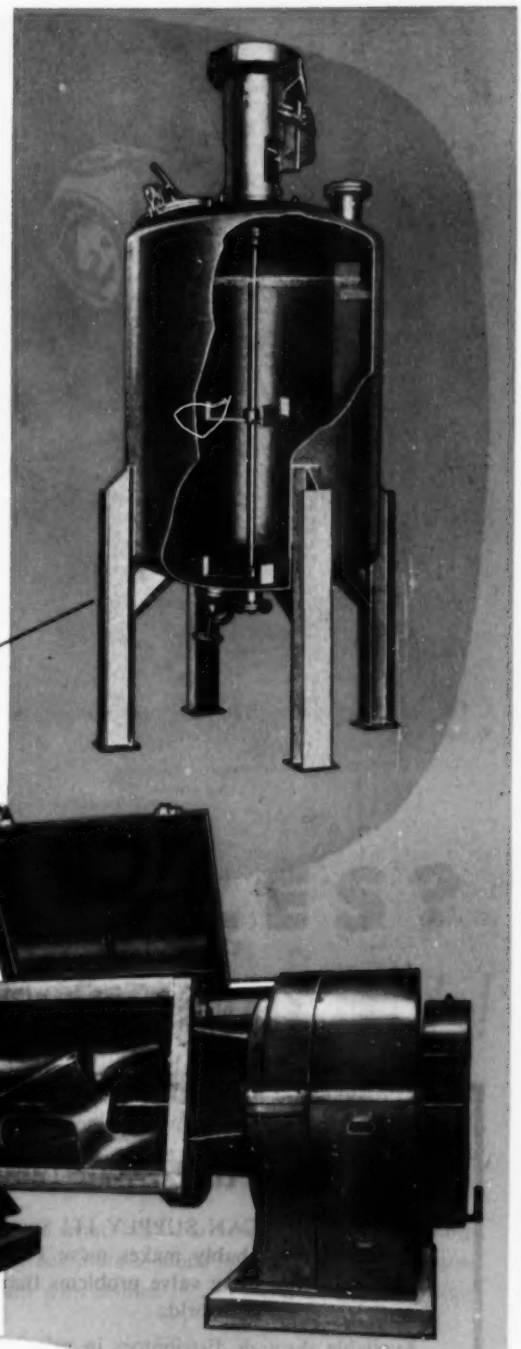
KNEADING MACHINE

Made in several types, Struthers Wells Kneading Machines are used for mixing stiff pastes. Some models may be rotated to a full inverted position for discharging.

INTENSIVE MIXER

Extremely powerful, Struthers Wells Intensive Mixers are suitable for processing plastics, rubber, asphalt tile and similar materials.





Struthers Wells

STRUTHERS WELLS CORPORATION

TITUSVILLE, PA.

Plants at

TITUSVILLE, PA. and WARREN, PA.

Offices in Principal Cities

Write for literature on equipment for your mixing requirements

For more data on advertised products, use Readers' Service Cards, last page.

"You see Powell Valves everywhere! And with . . .

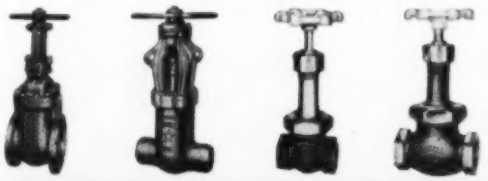
. . . good reason! They're famous for dependability. Economical, too.
What's more, Powell has a complete line."

Just name the valve needed...

. . . POWELL CAN SUPPLY IT! Small wonder—since Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

Available through distributors in principal cities. In bronze, iron, steel and corrosion resistant alloys. 1/8" to 30" and 125 pounds to 2500 pounds W.S.P. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

CONTROLS FOR THE LIFE LINES OF INDUSTRY



Powell Valves 108th year

New G-B

SNAP*ON

PIPE INSULATION

SIZES?

Large or small, we have them ALL!

Good news! G-B Snap*On Pipe Insulation is now available in a complete range of sizes and thicknesses for piping from ¾" to 24" in diameter. It is also available plain or with factory-applied vapor barrier facing. Now you can insulate hot and cold pipe of all sizes with this unique one-piece insulation molded of feather-light glass fibers!

"One-piece". . ."feather-light"—just picture what these characteristics mean in **savings.** They mean that one man can easily carry complete sections to the job . . . quickly snap them over pipe . . . quickly secure them with staples . . . easily paint or finish them as desired.

And due to the outstanding thermal efficiency of G-B Snap*On (K factor of .23 at 100° F. mean) you enjoy an important "second saving." For any given wall thickness, G-B Snap*On prevents more heat or cold loss than any pipe insulation on the market. Or to look at it another way, now you can use pipe insulation of thinner wall dimensions than you ordinarily use—and still achieve, or improve, thermal efficiency.

Seeing is believing—write today for samples and new 8-page brochure with complete descriptive and technical data.

gb

GUSTIN-BACON MANUFACTURING CO.

242 W. 10th STREET KANSAS CITY, MISSOURI

For more data on advertised products, use Readers' Service Cards, last page.

...THERE'S NO MAGIC ABOUT IT

...NEITHER ARE THERE ANY magical qualities in the ability to bring about successful on-stream completions when your process construction is handled by Procon.

To Procon personnel, the meeting of guarantees is an undivided responsibility . . . theirs alone . . . beginning the moment they are assigned to a new job . . . continuing throughout the construction period . . . ending only after the project has been completed to the customer's satisfaction.

It is this acknowledgement of responsibility which assures you of process construction that will meet your particular needs, whatever they may be. It is your guarantee that every detail, no matter how small or complex, will be carried out according to your specifications.

These are the qualities which result in satisfaction . . . your satisfaction . . . another reason for selecting Procon for your next process construction job.

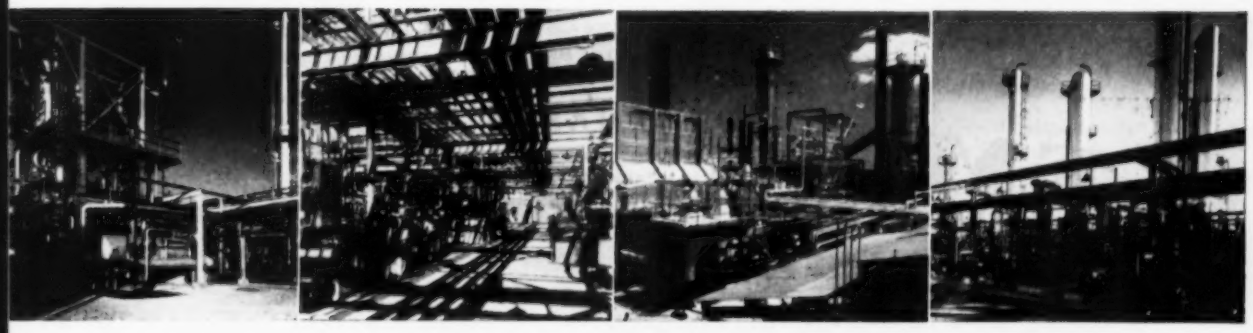
PROCON *Incorporated*

PROCESS CONSTRUCTION

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U. S. A.

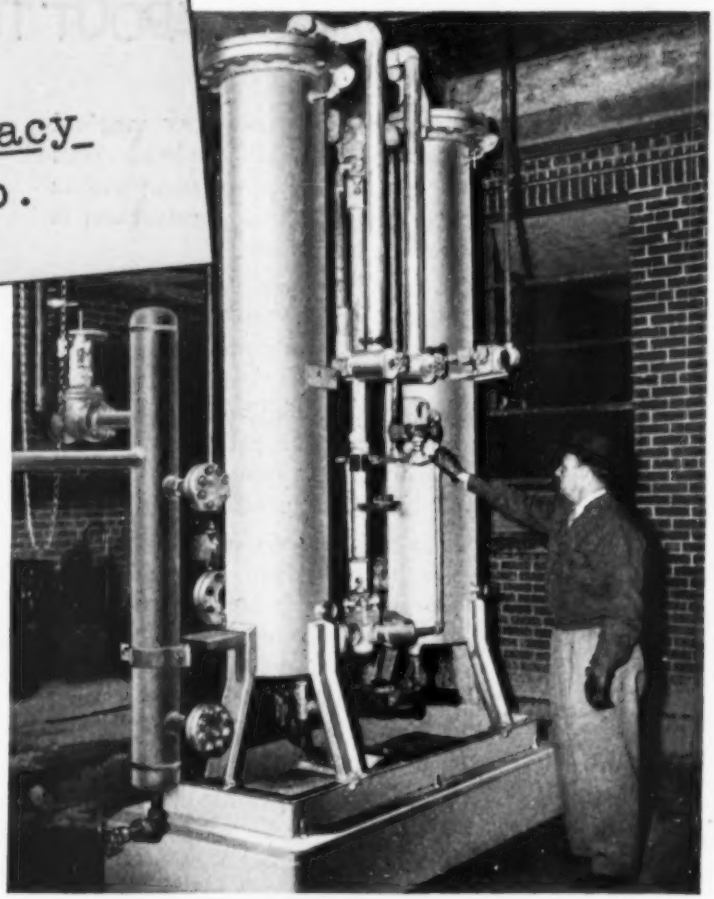
IN CANADA | PROCON (CANADA) LIMITED
40 ADVANCE ROAD
TORONTO 18, ONTARIO

IN ENGLAND | PROCON (GREAT BRITAIN) LIMITED
112 STRAND, LONDON, W. C. 2



Case No. 64

Kemp Dryer Assures Accuracy For Sun Oil Co.



How SUNOCO guarantees dependable instrument readings 24 hours a day

WHEN the Sunoco Plant at Marcus Hook, Pa., introduced a new process at the beginning of the year, many new instruments were installed. To dry the compressed air operating these instruments and assure accurate readings, Sunoco installed a Kemp Model 300 S Dryer.

Kemp Dryer Entirely Satisfactory

According to Harold Powers, Instrument Supervisor at Sunoco, the Kemp Dryer has been entirely satisfactory in performance. Operating continuously day and night since installation, it has performed according to specifications, has never been saturated, and has required very little attention.

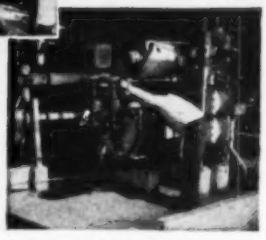
Kemp Dryers for Every Purpose

Kemp offers a variety of dryer models to meet all problems. Designed to dry air to sub-zero dew points at low cost, they are constructed of quality materials and embody the engineering knowledge gained from Kemp's many years of experience. They are available with manual, semi-automatic, or fully automatic tower reactivation. In addition, Kemp will prescribe the proper desiccant for each specific drying job. If you have a problem involving the removal of water from air, gases, or liquids, contact Kemp engineers now.

KEMP INERT GAS GENERATORS, too, serve Sunoco well

Sunoco reports that its two Kemp Inert Gas Generators have given highly satisfactory service. They are easy to start, and then operate automatically, requiring little attention. Both deliver high volume of gas of the proper analysis regardless of demand.

Kemp Inert Gas Generator Model C-5 MIHE. Delivers N_2 and CO_2 used to blanket top of wax tank.



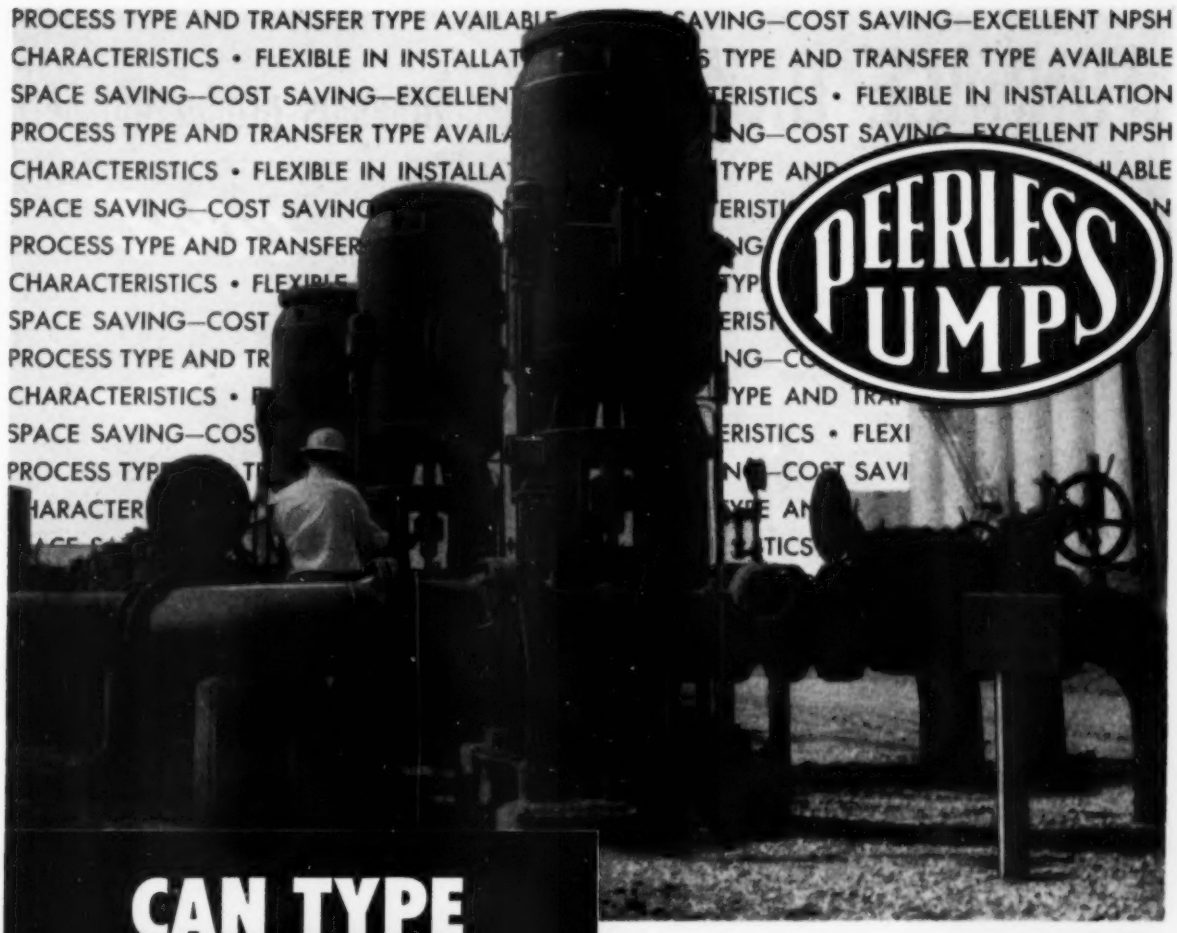
Kemp Inert Gas Generator Model 8 MIHE. Produces N_2 and CO_2 for blanketing and for bubbler systems. Located in the open.

For more complete facts and technical information, write for Bulletin D-27 to:
THE C. M. KEMP MFG. CO., 405 East Oliver Street, Baltimore 2, Md.

KEMP OF BALTIMORE

DYNAMIC DRYERS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • INERT GAS GENERATORS
SINGEING EQUIPMENT



CAN TYPE VERTICAL PUMP

Now Available in Two Types—FOR APPLICATION to CHEMICAL PROCESSING, REFINING TECHNIQUES, CONDENSATE SERVICE, AND LINE BOOSTER SERVICE

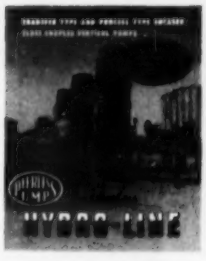
NEW DESIGNS PROVIDE BOTH A PROCESS TYPE AND A TRANSFER TYPE

The process type vertical Hydro-Line pump, especially suited to refining and process pumping offers the following features—1) API-ASME code welding; 2) especially designed containers for either mechanical shaft seals or packing; 3) availability of head and barrel flanges up to 300 lbs. or more; 4) extra heavy wall thicknesses for maximum stability and high safety factor; 5) elliptical barrel bottom design for optimum fluid entrance conditions. The transfer type Hydro-Line pump is of a similar design to the process type differing in materials of construction required for less rigorous service. Both types are extremely flexible in installation, are easy to inspect, service and maintain—can be designed for operation on any available system NPSH. Write for new Bulletin No B-1700.

THE PEERLESS HYDRO-LINE

ENCASED CLOSE-COUPLED PUMP

CAPACITIES TO	3000 gpm
HEADS TO	1000 feet
DRIVES	As required, vertical solid shaft, or explosion-proof motors; steam turbine.
TEMPERATURES	Up to 400° F.



PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Factories at: Los Angeles, Calif., and Indianapolis, Ind. ***Offices:*** New York; Atlanta; Chicago; St. Louis; Indianapolis; Phoenix; Fresno; Los Angeles; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.

Distributors in Principal Cities; Consult your Telephone Directory.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Please send me a copy of Peerless Hydro-Line Pump Bulletin No. B-1700.

NAME_____

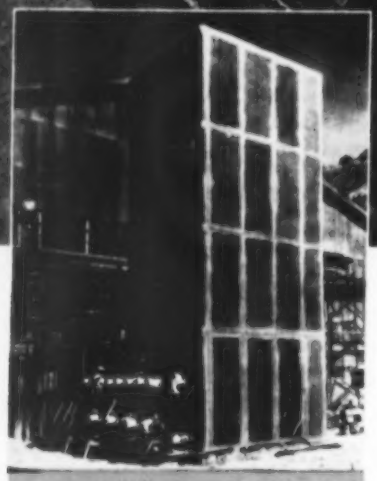
ADDRESS_____

TOWN_____ STATE_____

Pet. Refiner

For more data on advertised products, use Readers' Service Cards, last page.

TONNAGE OXYGEN... continuous production at lower cost



Stacey Brothers' design pioneered the use of welded-aluminum construction for all low temperature parts . . . utilizes modern-design reversing exchangers for efficient "no-shut-down" operation . . . requires no chemicals . . . needs only minimum operating crew.

Turn first to Stacey Brothers when you need a tonnage oxygen plant with long-time low costs of operation and maintenance. Take full advantage of Stacey's specialized experience in design, engineering, fabrication, construction . . . all the way thru to final Acceptance Testing.

Write for Bulletin 0-50, **the complete story about Stacey Brothers oxygen plants. *Standard Designs* are ready for plants producing 10 to 50 tons per day.**

All-Aluminum low temperature parts remain ductile, increase in tensile strength at sub-zero temperatures, have high thermal conductivity . . . welded joints insure against leakage.

Reversing Exchanger Design permits economical continuous operation . . . no shut-downs for de-riming.

Stacey BROTHERS

STACEY BROTHERS DIVISION
Dresser-Stacey Company
5535 VINE STREET
CINCINNATI 16, OHIO

One of the Dresser Industries

.... put all your eggs in one basket!

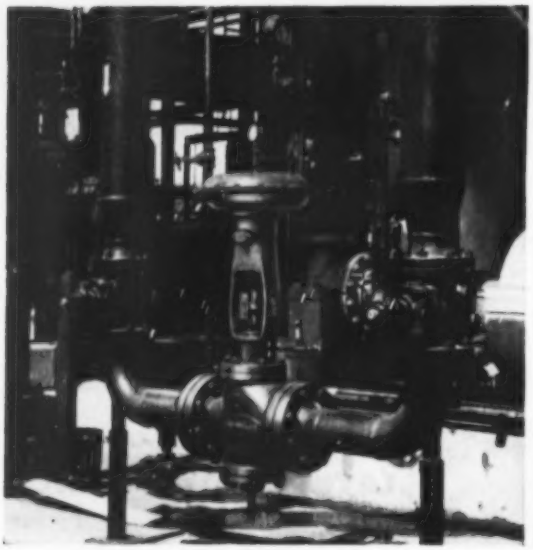
Whether it's water for municipality—industry—or farm, divided responsibility is dangerous. Put your eggs, all your eggs in one basket. Layne—the world's largest developer of ground water resources—offers a service that is truly unique. From preliminary exploration through well drilling to installation of equipment, you do business with one organization that assumes complete and undivided responsibility for the finished system. Wise men know that on any question that relates to water—it's good business sense to talk first to Layne.

LAYNE & BOWLER, INC.
Memphis 8, Tennessee

Layne

Layne Associate Companies Throughout the World

Water Wells • Vertical Turbine Pumps • Water Treatment

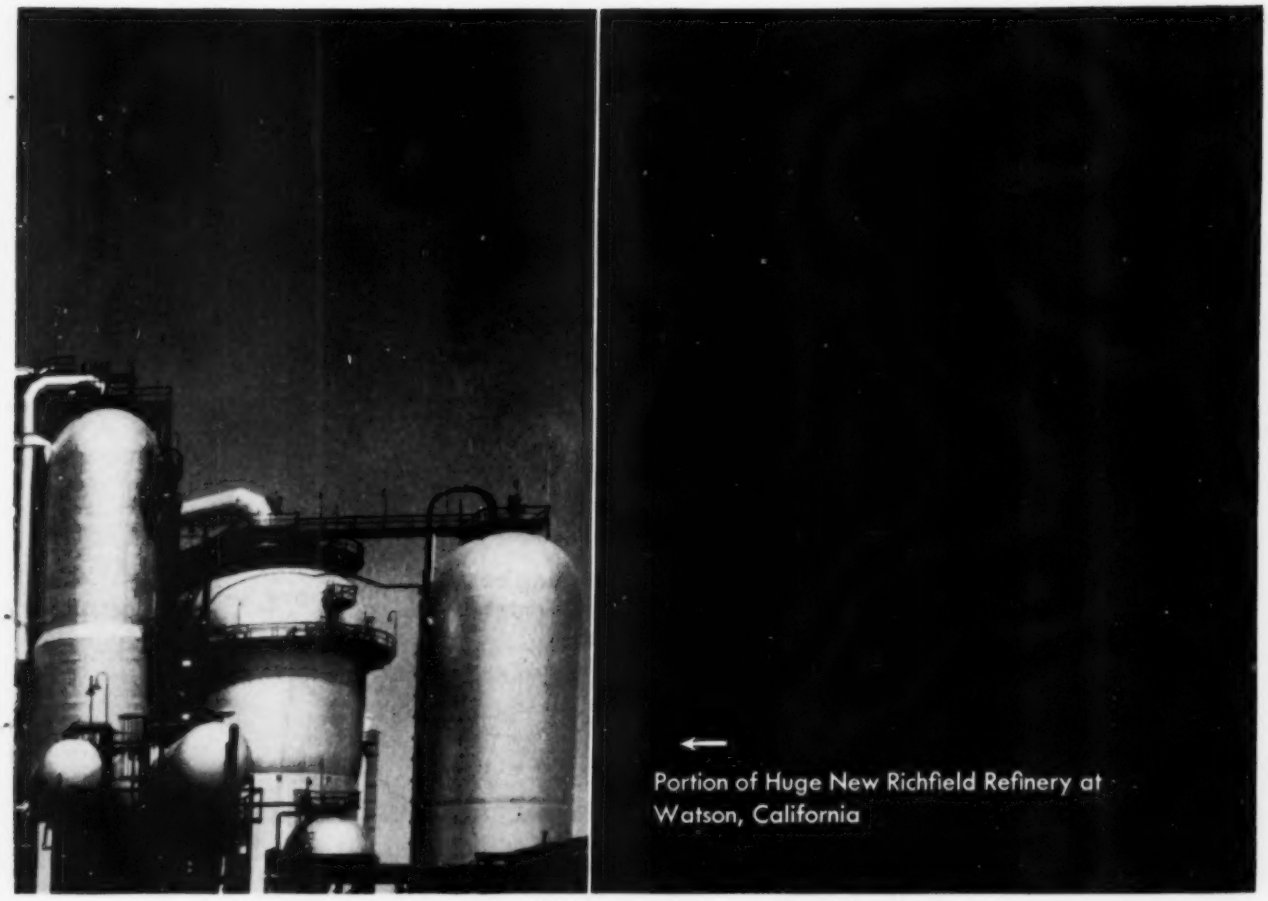


↑ Masoneilan 4" Double Seated Valve — one of many used in new Richfield Refinery

RICHFIELD SELECTS for New

Masoneilan 8" Single Seated Valve with 7000 Series Positioner ↓

For more data on advertised products, use Readers' Service Cards, last page.



Portion of Huge New Richfield Refinery at Watson, California

MASONEILAN CONTROL VALVES
$40,000,000 Refinery

All over the world, wherever quality of product depends on quality of equipment, companies like Richfield are selecting Masoneilan Control Valves — because over the years, experience proves they provide accurate performance over a long period with a minimum of maintenance. Low over-all cost thus makes these quality control valves the best buy for you in the long run.

If you do not have compiete data on Masoneilan Control Valves, it will pay you to investigate. Write

A HIGH Cq Quality Coefficient PRODUCT

MASON-NEILAN REGULATOR COMPANY

1182 ADAMS STREET, BOSTON 24, MASSACHUSETTS, U. S. A.

MASONEILAN

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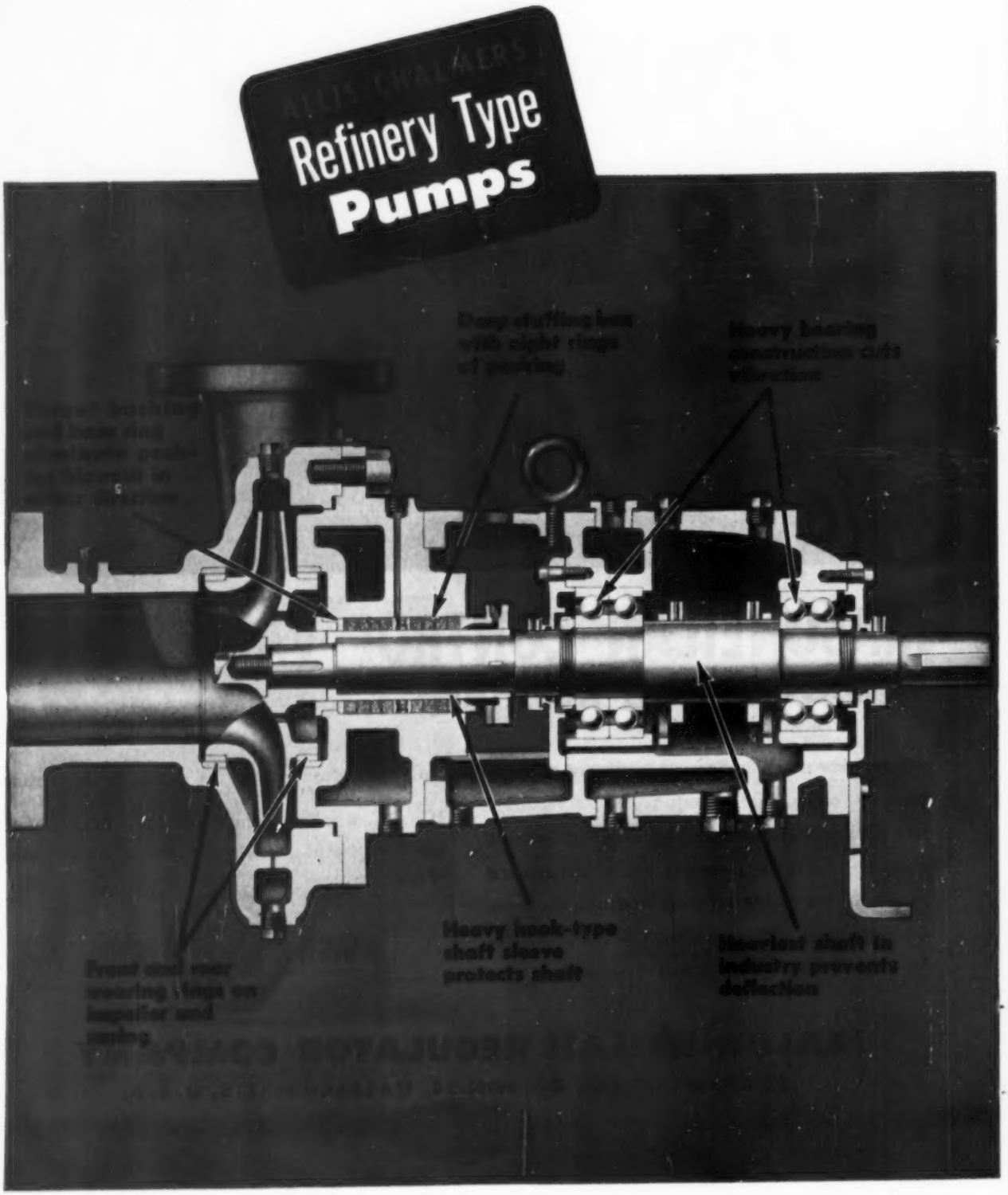
EXTRA heavy-duty construction


Refinery Type
Pumps
Deep stuffing box with eight rings of packing
Heavy bearing construction cuts deflection
Heavy hook-type shaft sleeve protects shaft
Heaviest shaft in industry prevents deflection
Front and rear wearing rings on impeller and casing

For more data on advertised products, use Readers' Service Cards, last page.

gives you service continuity

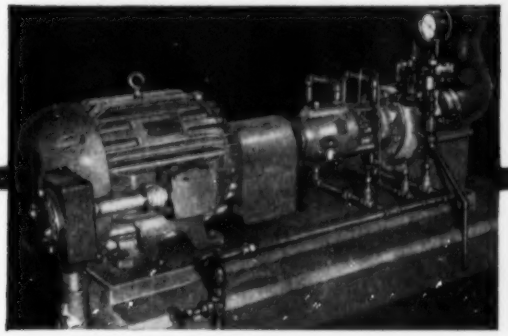
WHERE A STOPPAGE COSTS A FORTUNE, install Allis-Chalmers Refinery Pumps. These pumps have the stamina to keep going on the toughest applications for years without rest. Every construction detail, those shown here and many others, has been carefully engineered to provide ample reserves of strength and durability. Careful workmanship and expert application engineering make these pumps deliver all the reliability that is designed into them.

Wide Choice of Materials, Features

The Allis-Chalmers Refinery Pump can be fitted to suit your requirements exactly. Practically any material normally used in pumps may be specified. Stuffing box takes packing, mechanical seal or both. Cooling water or oil may be used in five separate places so you can select exactly the cooling arrangement for your particular needs. Suction may be at top or on end.

Get Complete Information and Engineering Help

Your nearby Allis-Chalmers representative will be glad to help you with your refinery pump problems. Or write for Bulletin 52B7775. Allis-Chalmers, Milwaukee 1, Wisconsin.



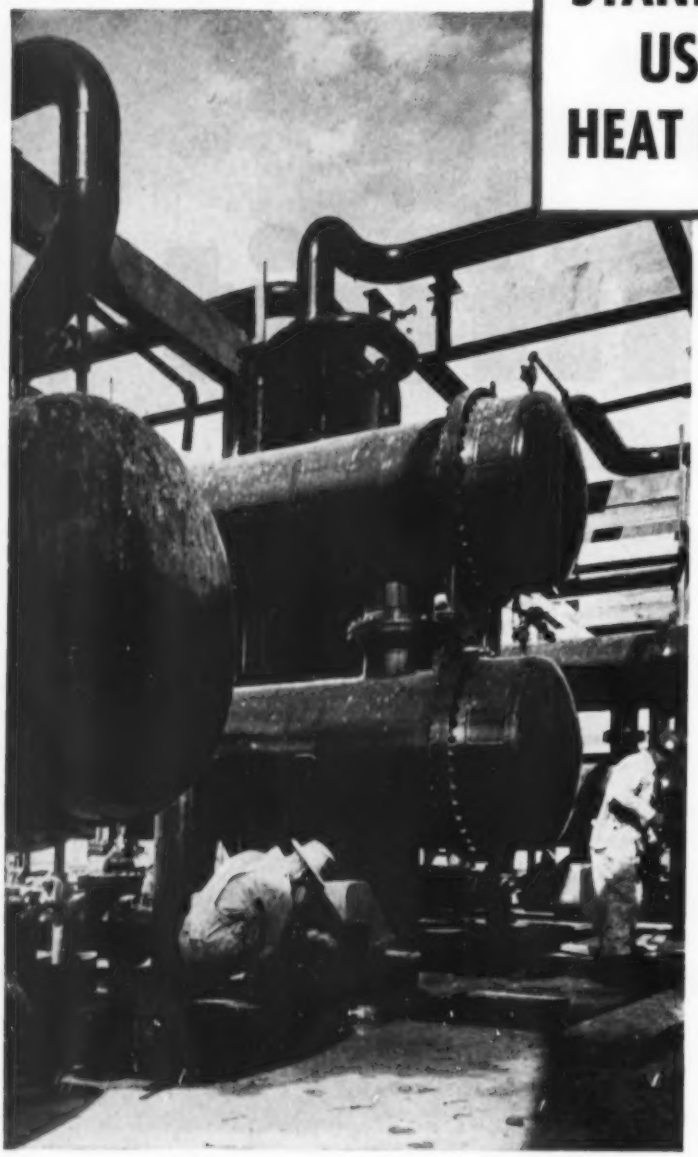
Save Engineering and Installation Time with an Allis-Chalmers Pump Package

Allis-Chalmers will supply a complete pumping unit — pump, motor and control — engineered to work together and with pump and motor mounted on a single base plate ready for installation. You save engineering time because you don't have to match components from different manufacturers. You save installation time because the unit comes to you already assembled. And, most important, you are sure that the components will work together to give you long life at low operating cost. The complete unit is covered by a single guarantee backed by Allis-Chalmers well-known customer satisfaction policy.

A-4333

ALLIS-CHALMERS

STANDARD OIL OF OHIO USES ELECTRUNITE HEAT EXCHANGER TUBES



Petroleum processing is hard on Heat Exchanger Tubes. Pressure, coupled with high temperature and tough corrosive conditions, can drastically affect the life of tubing.

In severe service like this, Republic ELECTRUNITE Tubing has advantages which extend the time between retubings. Republic ELECTRUNITE Tubes go through the latest type controlled reducing atmosphere furnace. Normalizing here relieves stresses, improves grain structure and ductility. There is no oxidation, no scale forms. And the dense surface produced by cold working in forming operations is unimpaired.

Installation costs are lower, too. ELECTRUNITE Heat Exchanger Tubes have uniform wall thickness, no longitudinal thin spots. Tubes expand evenly with less danger of over or underrolling. Uniform diameter means tubes slide easily and quickly through holes in drums or headers.

Petroleum processors have benefited from the advantages of ELECTRUNITE Heat Exchanger Tubes for many years. Get these same benefits by specifying Republic ELECTRUNITE Pressure Tubes on your next order for heat exchangers or retubing. For more information, write to:

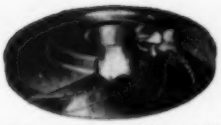
REPUBLIC STEEL CORPORATION
Steel and Tube Division
220 East 131st Street, Cleveland 8, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
REPUBLIC STEEL
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

For more data on advertised products, use Readers' Service Cards, last page.

ALLIS-CHALMERS

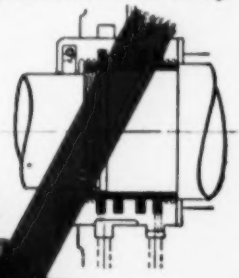
Multi-Stage Centrifugal Blowers

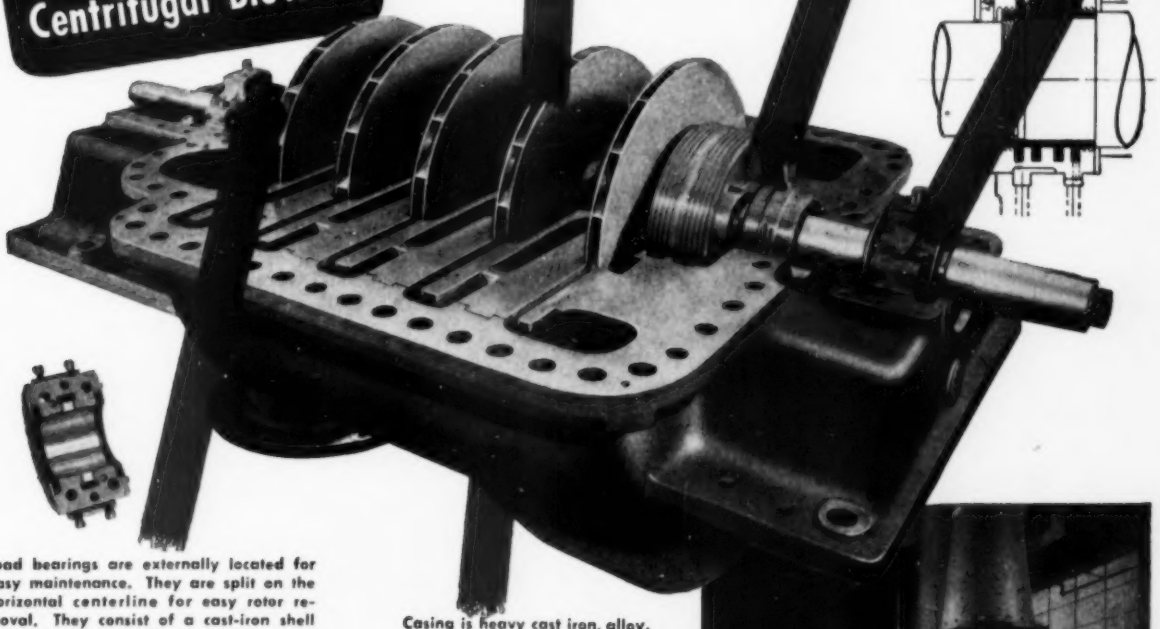


Impeller construction provides unobstructed passage of air or gas. Impellers are furnished in riveted or welded types, as determined by impeller dimension. Note that in riveted impeller wheels, rivets are integral with, and milled from, blade stock.

Impeller wheels are located accurately on shaft with sleeves and are mounted with light shrink fit. Bores are ground to size. Lock nuts prevent axial movement.

Sealing during operation is provided by oil pressure seals. A carbon ring seal prevents leakage when blower is not running.





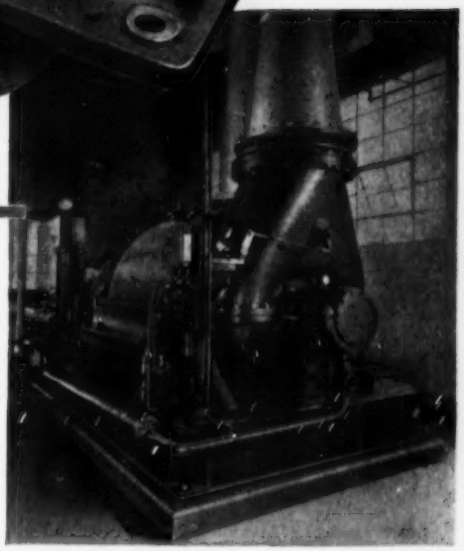
Load bearings are externally located for easy maintenance. They are split on the horizontal centerline for easy rotor removal. They consist of a cast-iron shell with removable, babbit-lined steel inserts.

Casing is heavy cast iron, alloy, or forged steel.

Why these blowers can run for years *without stopping*

The key to "round the clock" performance in fluid catalytic cracking plants is *quality*, as illustrated in the features above.

For highly dependable, low maintenance air and gas handling equipment, as well as motors and control, call your nearby Allis-Chalmers office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4465

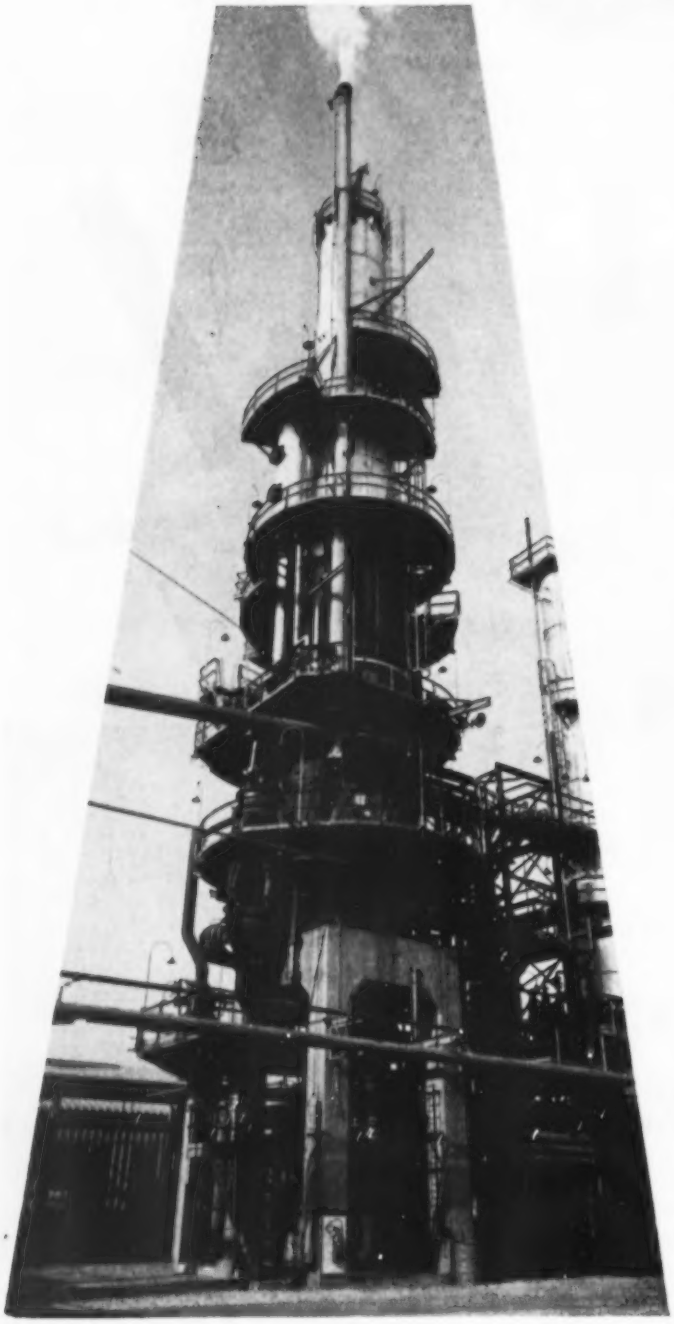


This Allis-Chalmers four-stage centrifugal blower supplies 24,000 cfm to the catalytic cracking tower of an eastern refinery on a 24-hour-a-day basis, month in and month out.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

REACTOR REGENERATOR



built for Louisville refinery

Chicago Bridge & Iron Company recently built the 7000-bbl. per day reactor-regenerator complete with platforms, shown at the left for the Louisville Refining Company at Louisville, Kentucky.

For more than 64 years, Chicago Bridge & Iron Company has been called upon by the petroleum industry to solve complicated and unusual welded steel plate problems. Today, CB&I's plants have complete equipment for fabricating structures of carbon steel, carbon steel lined or clad with non-corrosive metal, and structures of solid non-corrosive metals. We also have complete facilities for pickling and painting steel-plates and shapes and for X-raying and stress relieving to code requirements. Our engineering, fabricating and erection departments are backed by the years of experience and facilities that it takes to build refinery structures to engineering specifications.

Information, estimates or quotations on any Horton® welded steel plate structure may be obtained by writing our nearest office. There is no obligation on your part.

WELDED STEEL PLATE STRUCTURES FOR THE PETROLEUM INDUSTRY

Hortondome Roof Tanks	Flat Bottom Tanks
Elevated Water Tanks	Refinery Towers
Horton Floating Roofs	Hortonspheroids
Horton Vaporspheres	Hortonspheres
Horton Vaportanks	Hemispheroids

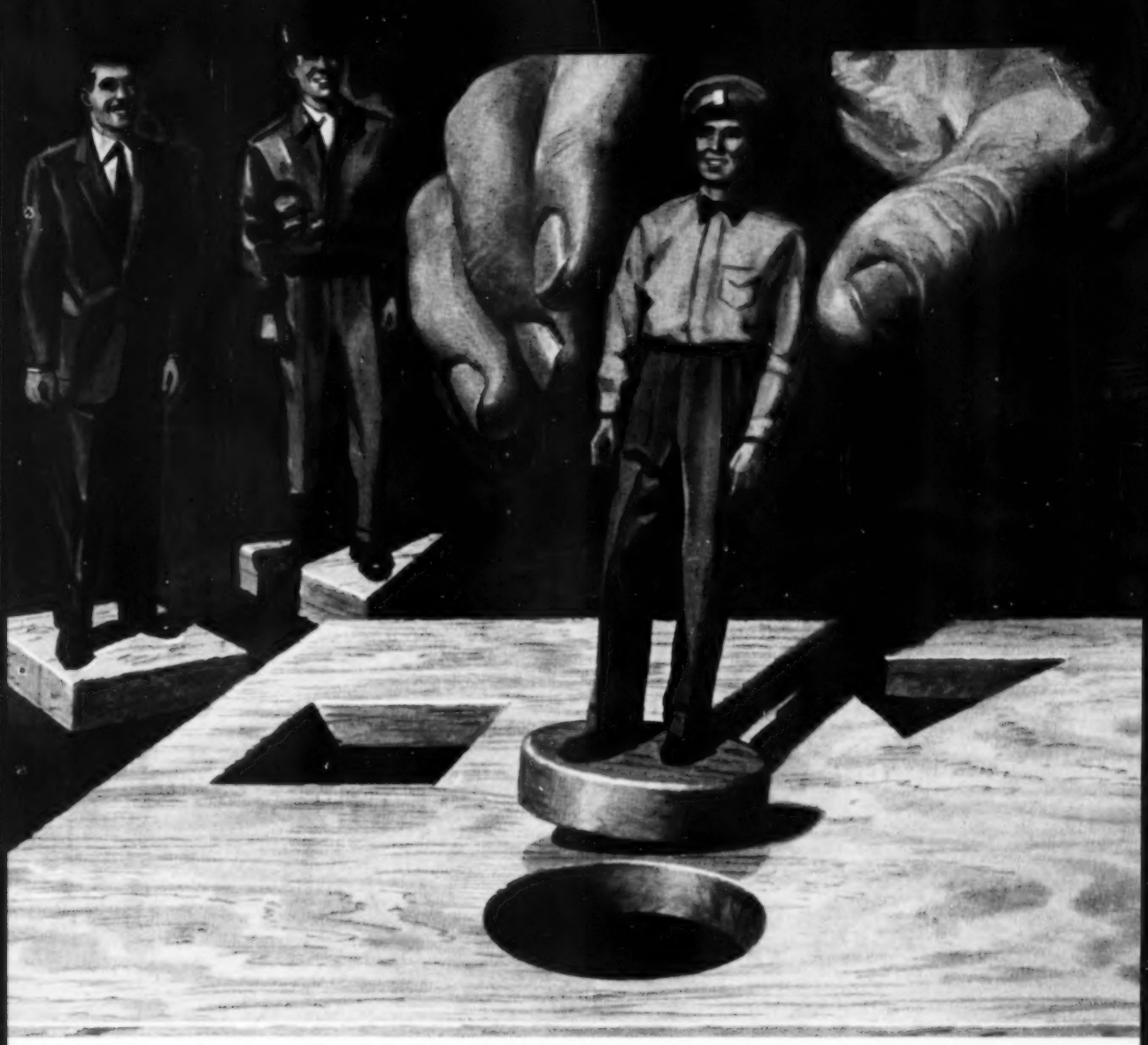
CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Atlanta 3	2146 Healey Building	Detroit 26	1520 Lafayette Building	Pittsburgh 19	3237 Alcoa Building
Birmingham 1	1548 North Fiftieth Street	Houston 2	2126 C & I Life Building	Salt Lake City 4	531 West 17th South Street
Boston 10	1030—201 Devonshire Street	Los Angeles 17	1534 General Petroleum Building	San Francisco 4	1551—200 Bush Street
Chicago 4	2463 McCormick Building	New York 6	3302—165 Broadway Building	Seattle 1	1331 Henry Building
Cleveland 15	2234 Midland Building	Philadelphia 3	1608—1700 Walnut Street Building	Tulsa 3	1626 Hunt Building

REPRESENTATIVES AND LICENSEES

Ateliers et Chantiers de la Seine Maritime, Paris, France
Compagnia Tecnica Industrie Petroli, Rome, Italy
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348, Caracas, Venezuela
Sociedade Chibridge de Construcoes Ltda., Av. General Justo 275, Grupo 306, Rio de Janeiro, Brazil
Horton Steel Works Limited, Fort Erie, Ontario, Canada
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Whessoe, Limited, Darlington, England
Comprimo N. V., 21, Amstel, Amsterdam (C) Netherlands



Helping dealers to find the right man

Have you heard about the new program to attract and keep better-quality men in service-station jobs?

It's a new Ethyl service.

Called Ethyl's Recruiting and Training program, it will, we believe, be a valuable supplement to the work of individual oil companies, and the committees of the API and other associations which are concerned with this problem. Here, in brief, is the story.

First, to get the complete national picture, we asked more than 4,500 dealers employing more than 15,000 attendants to tell us about their personnel problems. Nearly all reported they had difficulties in recruiting, hiring and training their people. So much so, that nearly half of those hired left because they were "unsatisfactory," and nearly

(*Continued on next page*)

ETHYL

Printed in U. S. A.

Helping dealers to find the right man

(*Continued from preceding page*)

60% of the men working as attendants had experience of only one year or less.

So we sat down with vocational-guidance people and men from the petroleum industry and worked out our new R. T. (Recruiting and Training) program.

We reasoned, after a good deal of study, that if more people knew of the fine opportunities available in service-station employment, better men would be interested. So a film, booklets, and special kits were created to take this message to young men and their families.

And to help bring these better recruits along, Ethyl's dealer-training materials and services are being enlarged and streamlined.

We hope this new Ethyl service can help your dealers build a better and more stable service-station sales force. Our prime objective is to help the industry in one of its more vulnerable areas: the front door of its business.

ETHYL CORPORATION
NEW YORK 17, NEW YORK

WORTH NOTING

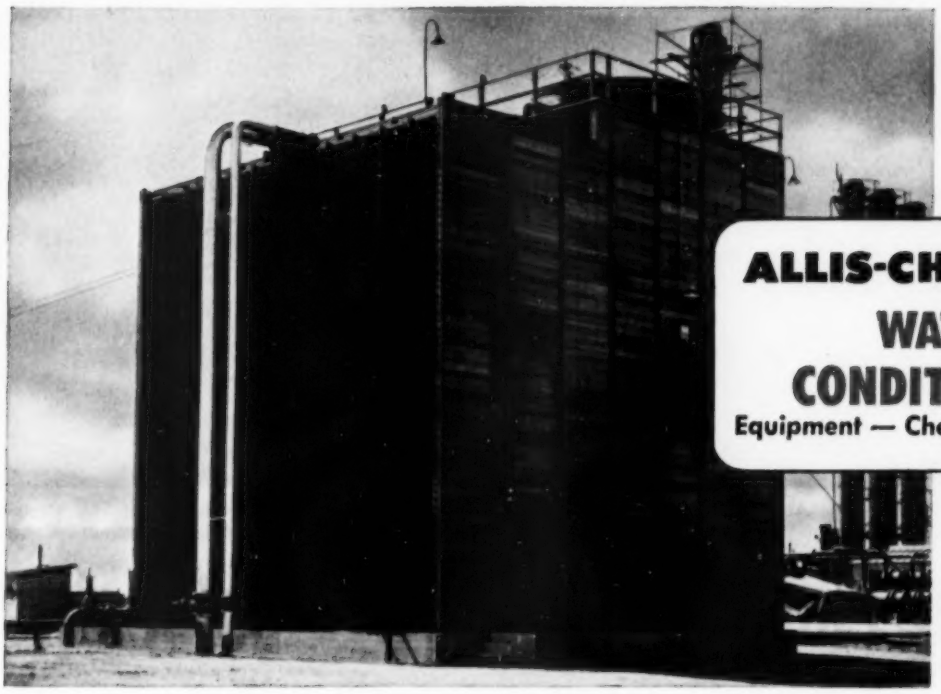
One of the first demonstrations of the superiority of "Ethyl" gasoline occurred at the 1924 Indianapolis Memorial Day Race. Out of a field of twenty-one, the seven cars fueled with gasoline containing "Ethyl" antiknock compound won the first seven places.

The portable lead-in-air analyzer, now considered one of the petroleum industry's most important safety tools, was developed and first produced by Ethyl Corporation.

One teaspoon of "Ethyl" antiknock compound can raise a gallon of gasoline as much as 10 research octane numbers.

Ethyl Service is backed by 31 years of antiknock experience

SOLVING WATER PROBLEMS in Cooling Towers



ALLIS-CHALMERS
WATER CONDITIONING
Equipment — Chemicals — Service

Use of cooling towers to save on water brings unusual problems. Some of these problems are corrosion, scaling, algae and slime, and deterioration of wood in the tower. Allis-Chalmers recently published an informational bulletin, Number 47A, which explains the causes of these problems and what can be done about them.

Part of Practical Library

This bulletin is one of a series published by Allis-Chalmers to help you understand the causes and solutions of many water problems. It is the result of Allis-Chalmers experience solving water problems for every industry, in addition to solving problems involved in the company's own broad line of steam turbine and power plant equipment.

Complete Water Conditioning Service

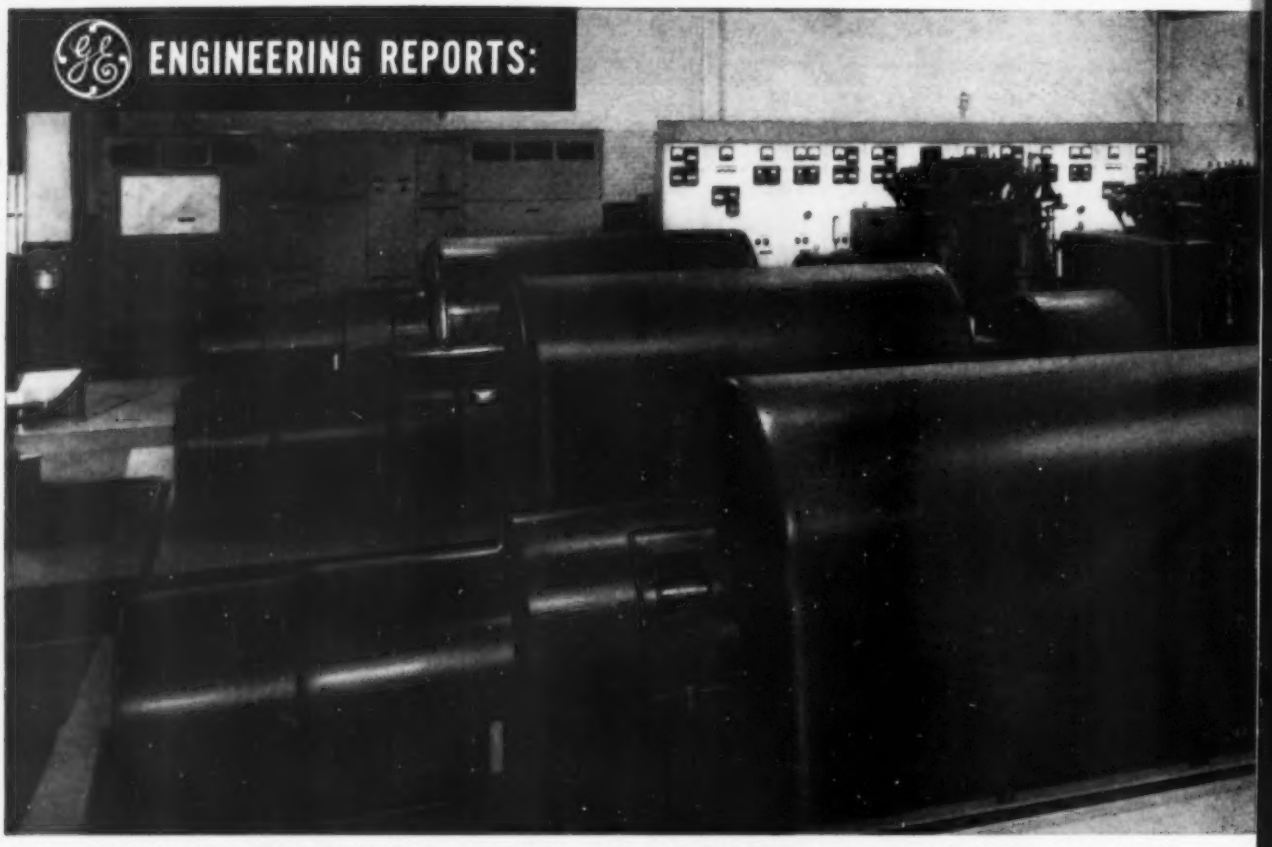
Allis-Chalmers offers complete water conditioning service. You can get analyses and reports on your problems. You can get chemicals needed in water treatment. And you can get the equipment needed for any system.

A-4316

Get Information — For your copy of Bulletin 47A on water treatment for cooling towers, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby A-C district office to have an Allis-Chalmers water conditioning engineer consult with you on your problems.

ALLIS-CHALMERS

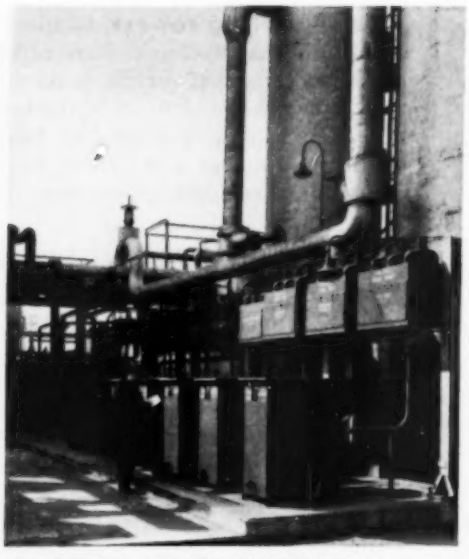
For more data on advertised products, use Readers' Service Cards, last page.



A SOURCE FOR PROCESS STEAM DEMAND, these G-E 6000-kw automatic extraction non-condensing turbine-generators at Sinclair's East Chicago refinery economically provide electric power as a by-product, help maintain plant steam balance.

General Electric power system helps

POWER CONTINUITY for uninterrupted production is provided by this G-E 4000-kva double-ended master unit substation. Normally-open tie circuit breaker provides an alternate power source if either transformer is de-energized.



PROTECTION AGAINST OVERLOADS is an advantage of these G-E oil fuse cutouts, which also can be used for switching at the Sinclair plant.

Incoming steam, at 900 lb pressure, and 900 F temperature is automatically extracted at 565 lb pressure for plant process use. Turbine's efficiency, reliability and long life also keep operating costs low.

Sinclair reach peak 110,000 bbl/day output

Modern East Chicago refinery utilizes co-ordinated G-E power system for top efficiency

One of the larger units in the industry, Sinclair's East Chicago refinery produces a complete range of petroleum products—at 110,000 barrels per day. Here is modern catalytic equipment—a polymerization plant to produce gasoline from light hydrocarbons—an alkylation plant to produce aviation gasoline.

General Electric equipment, working together as an integrated system, helps keep the East Chicago refinery operating at top efficiency—another example of G-E electrical systems providing continuity of production in petroleum refineries.

G-E application engineers, specializing in refinery systems, helped co-ordinate the plant's power-system equipment to fit its specific processing needs. G-E field engineers assisted with installation of equipment. Whether you build, expand, or modernize, these and other G-E Engineering services can help you to make the most of your electric equipment investment.

Cut your power distribution costs with the help of the full-color sound slidefilm, "The Vital Link," a G-E More Power to America program. Ask your G-E Apparatus Sales representative to arrange a showing. General Electric Co., Schenectady 5, N. Y.

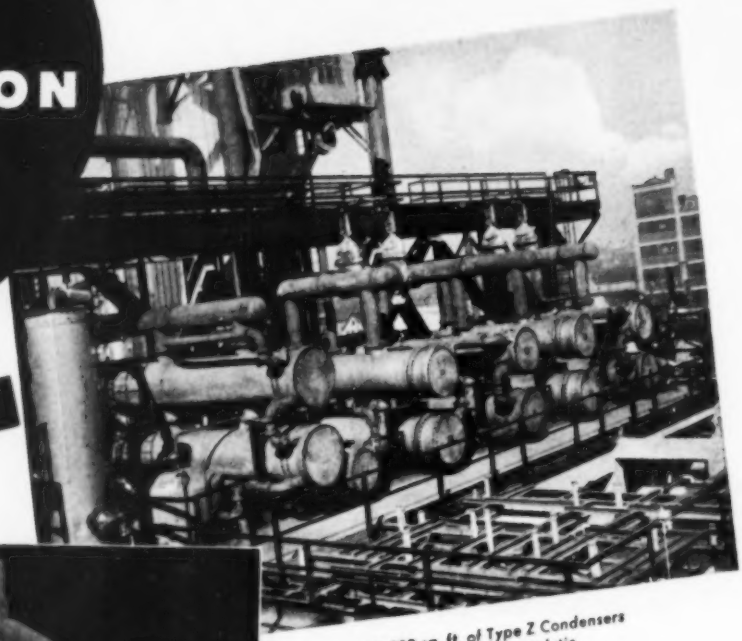
661-48

Engineered Electrical Systems for Petroleum Refineries

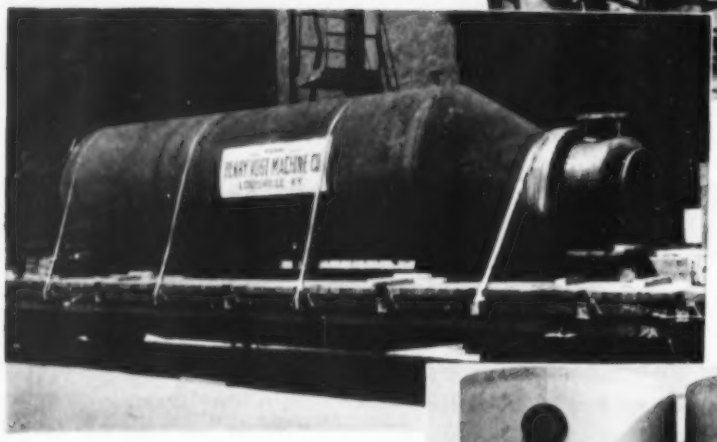
GENERAL ELECTRIC

For more data on advertised products, use Readers' Service Cards, last page.

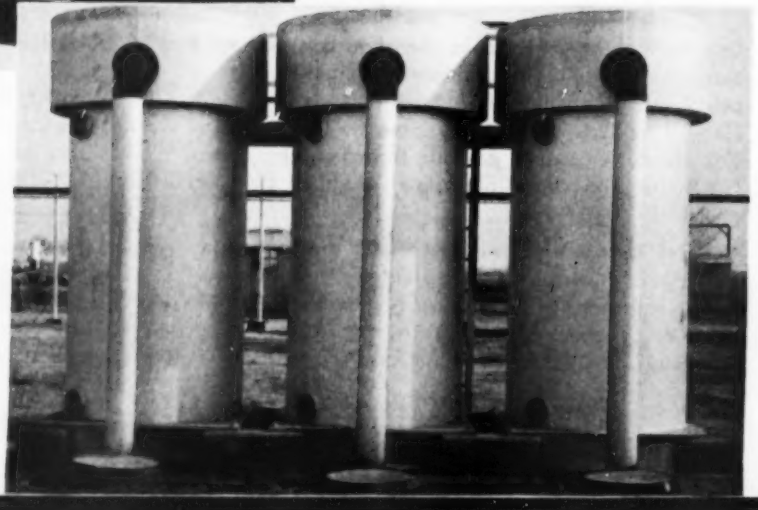
Better
DESIGN
Better
CONSTRUCTION
Better
VALUE



30,000 sq. ft. of Type Z Condensers in a modern catalytic refinery installation.



A Type KW Reactivator Reboiler for a Texas chemical plant.



Three Type A Jacket Water Coolers which serve engines totaling 7300 horse power. Muddy well water is the cooling medium.

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

For more data on advertised products, use Readers' Service Cards, last page.

by Vogt

Many years of unmatched experience gained from solving the heat transfer problems of diversified industrial plants has given Vogt a priceless wealth of engineering "know-how."

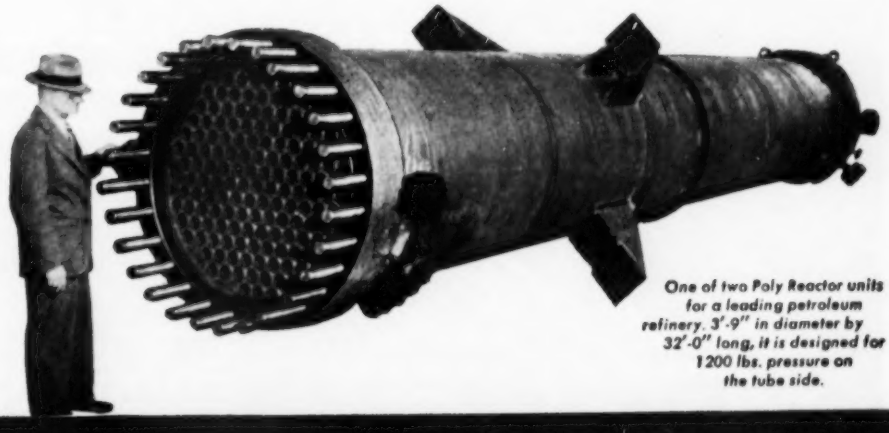
When you specify Vogt Heat Transfer Equipment you are SURE of . . .

(1) BETTER DESIGN . . . because Vogt engineers carefully weigh and evaluate the conditions peculiar to the specific service for each individual application. Thereby the correct proportioning of heat transfer surfaces and arrangement of baffles is determined and the proper materials selected for the unit. Exchangers have been designed for temperatures as low as minus 160°F. and as high as 1600°F., and pressures ranging from vacuum to 9500 pounds per square inch.

(2) BETTER CONSTRUCTION . . . because Vogt has the most modern facilities with which to form, machine, weld, X-ray, and stress relieve; all manned by skilled operating personnel. Tubes are always properly supported to prevent excessive deflection and baffles are accurately aligned and fitted to facilitate ease of tube replacement or removal of bundles from shells.

(3) BETTER VALUE . . . because of savings which accrue from better design and better construction. Correct design insures maximum heat transfer and minimum fouling, to substantially cut operating costs. Better construction assures low maintenance expense because of proper materials selection and fabrication techniques. This insures resistance to corrosion and leakage whereby down time for cleaning and repairs is reduced to a minimum. *Vogt Heat transfer units are fabricated from carbon and stainless steels, Monel, nickel, Inconel, silicon bronze, aluminum and other non-ferrous materials. Plastic materials are used when required to meet special problems.*

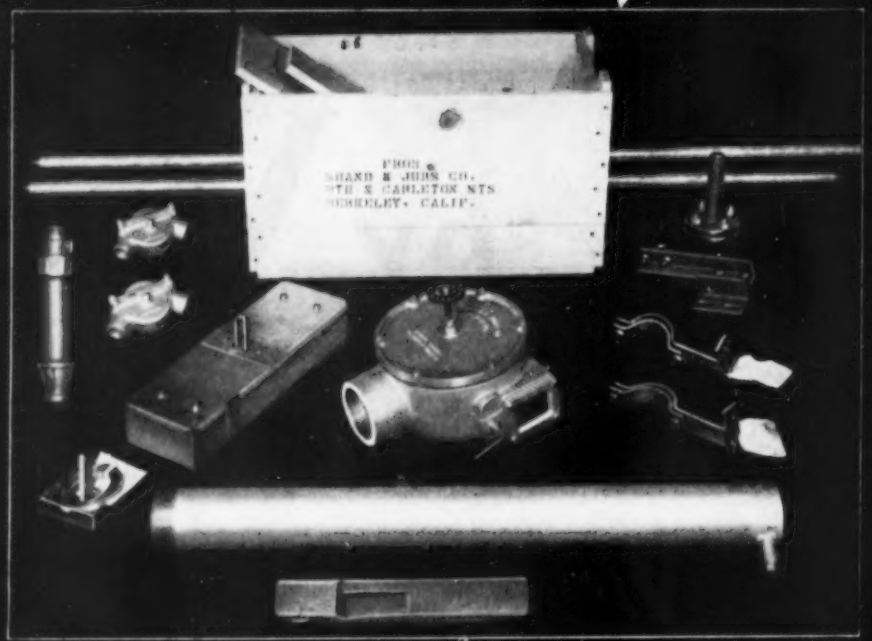
Write for
Bulletin HE-6



One of two Poly Reactor units for a leading petroleum refinery. 3'-9" in diameter by 32'-0" long, it is designed for 1200 lbs. pressure on the tube side.

For more data on advertised products, use Readers' Service Cards, last page.

A COMPLETE PACKAGE—
No Extras to Buy!



HERE is a complete Shand & Jurs Automatic Gage for mounting directly onto bolted stock tanks. Everything needed for immediate installation is supplied in one package. There's absolutely nothing more to buy before putting this S&J Automatic tank gage into operation.

The bracket flanges are drilled and ready for mounting on the bolts already on the stock tank. Even the pipe, cut to length for 16′ 1″ high bolted stock tanks, is supplied.

Designated by S&J as Fig. ST-2935, this is the same high quality S&J Automatic Tank Gage that has earned its reputation for maximum dependability and accurate measurement through years of service in the field. Now you can equip your bolted stock tank with an automatic S&J tank gage, supplied complete in one delivery.

S&J

Shand and Jurs Co.

BERKELEY 10, CALIFORNIA

NEW YORK
342 Madison Ave.

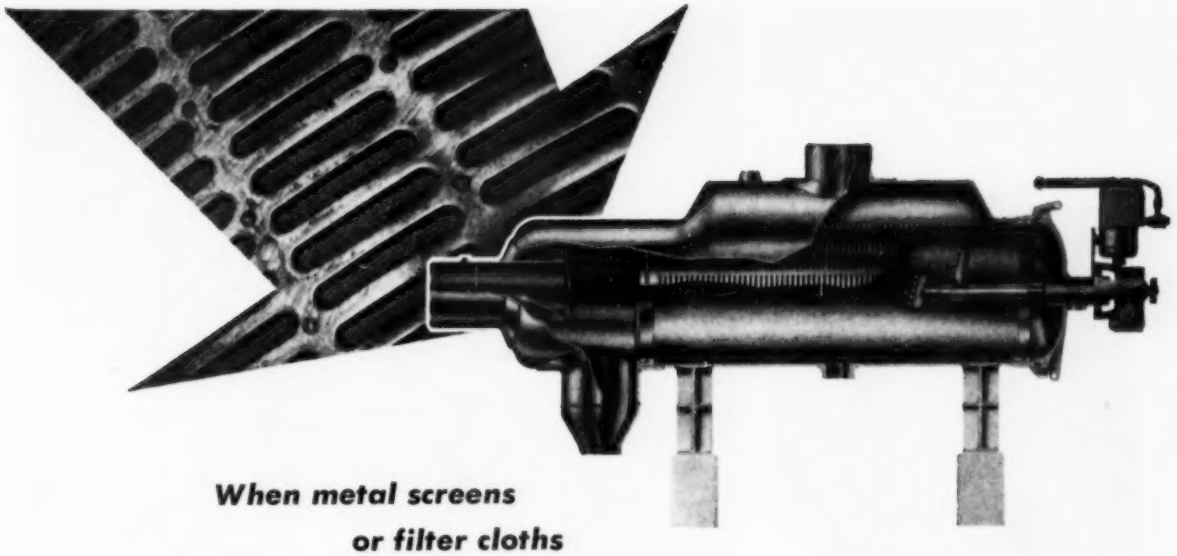
HOUSTON
M & M Bldg.

TULSA
Thompson Bldg.

CHICAGO
10409 S. Western Ave.

LOS ANGELES
714 W. Olympic Blvd.

REPRESENTATIVES:
SEATTLE: Nebar Supply Company, 3000 Western Avenue
MONTREAL: Lytle Engineering Specialties, Ltd., 360 Notre Dame St., W.
TORONTO: Lytle Engineering Specialties, Ltd., 85 Richmond St., W.
VANCOUVER: P. D. McLaren & Son, Ltd., 3277 Main Street
CARACAS: Sinclair Spence, C.A., Edificio Galipan
ENGLAND: Whessoe, Ltd., Sales: 25 Victoria St., London, S.W. 1
Whessoe, Ltd., Works: Darlington, County Durham



When metal screens or filter cloths

"GUM UP the WORKS"...

A distinctive feature of the Jet-Type Self-Cleaning Fluid Strainer is the banks of rotating jets which are arranged inside the Monel basket to flush away built-up solids in three to five minutes... without the need to open the unit or remove the basket. Ease of cleaning makes it possible to employ a finer mesh screen, if desired, assuring a brighter product stream. For more information on this equipment, write direct to THORNHILL-CRAVER COMPANY, INC., P. O. Box 1184, Houston, Texas.

Take a tip from a well-known manufacturer of pipe line strainers and other petroleum equipment.

Several years ago, THORNHILL-CRAVER COMPANY, of Houston, Texas, set out to design a strainer that would reduce the time and labor necessary for cleaning. They wanted a strainer that could be cleaned in a matter of minutes without dismantling and that would make bypassing unnecessary. The result was the Jet-Type Self-Cleaning Fluid Strainer.

Since the advantage of a unit of this type lies in its easy, trouble-free operation, they needed a screen that would last indefinitely... that would resist abrasion by entrained solids and stand up against corrosion by the widest range of products.

Monel wire screen and cloth is widely used throughout industry wherever corrosion resistance or product purity is important — for filtering or screening chemicals, brines, alkalies... acid sludges and acidic clay-treated distillates... mud ... hydraulic oil ... for tower packing ... flame arrester screens on tank breather lines... and others.

You'll find that Monel screen and filter cloth is made in all standard weaves and meshes. It can easily be formed to almost any desired shape or size.

Whether it's a question of original equipment or replacements, take advantage of the experience of THORNHILL-CRAVER. You, too, may find that Monel is the answer to your screening or filtration problems. For information on Monel screen and filter cloth, write Inco for a copy of "Established Weavers of Monel ... Nickel ... Inconel."

It is advisable to place equipment orders with your supplier well in advance of scheduled use. Distributors of INCO Nickel Alloys can supply the latest information on availability from warehouse or mill.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street **New York 5, N. Y.**

Inco Nickel Alloys

INCO **Monel**... *for minimum maintenance*

For more data on advertised products, use Readers' Service Cards, last page.

EC&M Bulletin 1062 Type ZHS 2300-volt Motor Starter in Type VIII enclosure for Class I, Group D hazardous atmospheric locations.

Motor Starters

2200 TO 5000 VOLTS!

HELP BOOST PETROLEUM PRODUCTION

● For maximum protection in hazardous locations, all connections, terminals and arcing parts of these Type ZHS Motor Starters are oil-immersed. In addition, oil-immersion keeps the mechanism thoroughly lubricated and protected against corrosion . . . eliminates the need for frequent inspection or maintenance.

These motor starters have self-contained, adjustable overload relays with inverse-time-element feature which protects motors from overheating as a result of overload, loss of one phase or failure to start. Of combination type, these relays assure instantaneous trip on heavy overloads or short circuits.

EC&M Type ZHS Starters for 2200 to 5000-volt motors are built in 50,000 KVA interrupting capacity and in the VALIMITOR (volt-ampere-limitor) style for use on power systems having infinite KVA.

Throughout the petroleum industry, EC&M Motor Starters are providing continuous safe service . . . helping to boost petroleum production.

Write for Booklet 1062 describing EC&M 2200-5000-volt motor starters

1004

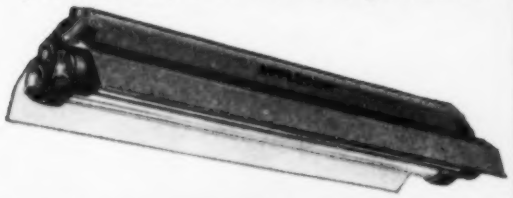
THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79TH STREET • CLEVELAND 4, OHIO

NOW . . . a NEW Rapid Start BALLAST

for longer lamp and ballast life

plus quiet, flickerless operation



APPLETON

"EFU" Explosion Proof

FLUORESCENT FIXTURES

BRIGHT, SAFE ILLUMINATION FOR HAZARDOUS LOCATIONS

Complete protection against explosion hazards from lighting equipment is afforded this spray area through the use of APPLETON "EFU" Fixtures. Convenient angle mounting sheds light directly and evenly on the work area. Hazardous locations in refineries, grain mills, color printing plants, chemical plants, pharmaceutical concerns, etc., may be protected in the same manner.

● FOR SAFETY AND SAVINGS, specify *APPLETON "EFU" Explosion-Proof Fluorescent Fixtures and Fittings* . . . a complete quality line from one dependable source. Three different high power factor ballasts are available now, including a new "Rapid Start" for long lamp life, long ballast life without starters, and quiet, flickerless operation. Re-lamping is permitted from either end of fixture, and the APPLETON factory seal eliminates external seals normally required within 18 inches of arcing devices. Whatever the lighting problem, an APPLETON "EFU" installation assures maximum safety, high light output and trouble-free economical service.

Sold Exclusively Through Selected Wholesalers

2, 3 and 4-Lamp Fixtures . . . Straight or Angle Mounting

Choice of "Pre-Heat," "Slimline" or new "Rapid Start" ballasts. Designed for use with 40-Watt, 48-inch, T-12, and 85, 90 or 100-Watt, 60-inch, T-17 fluorescent lamps. End housings are cast aluminum with line connections made to a terminal block in the junction chamber.

APPLETON ELECTRIC COMPANY
1732 Wellington Avenue • Chicago 13, Illinois

Also Manufacturers of:

APPLETON ELECTRIC PRODUCTS

Rely on **APPLETON** *. . . The Standard for Better Lighting*

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Two Terry Turbines equipped with "trouble eliminators"

Because these turbines have solid wheels, they can take a lot of abuse, without complaint. Here's why:

1. The wheel has no separate parts to become loose or work out. It is a single forging, in which a series of semi-circular buckets is milled.

2. Blade wear is of little consequence because the power-producing action of the steam takes place on the curved surfaces at the back of the buckets. Wear does not materially affect horsepower or efficiency.

3. The blades cannot foul. There is a one inch clearance on either side of the wheel and, in addition, the blades are double rim protected. There is no need for close axial blade clearance, because the steam enters the buckets in a direction at right angles to the shaft.

For complete details of these *work horses of industry*, send for a copy of bulletin S-116. No cost or obligation.

THE TERRY STEAM TURBINE CO.

TERRY SQUARE, HARTFORD 1, CONN.

TERRY

TT-1199

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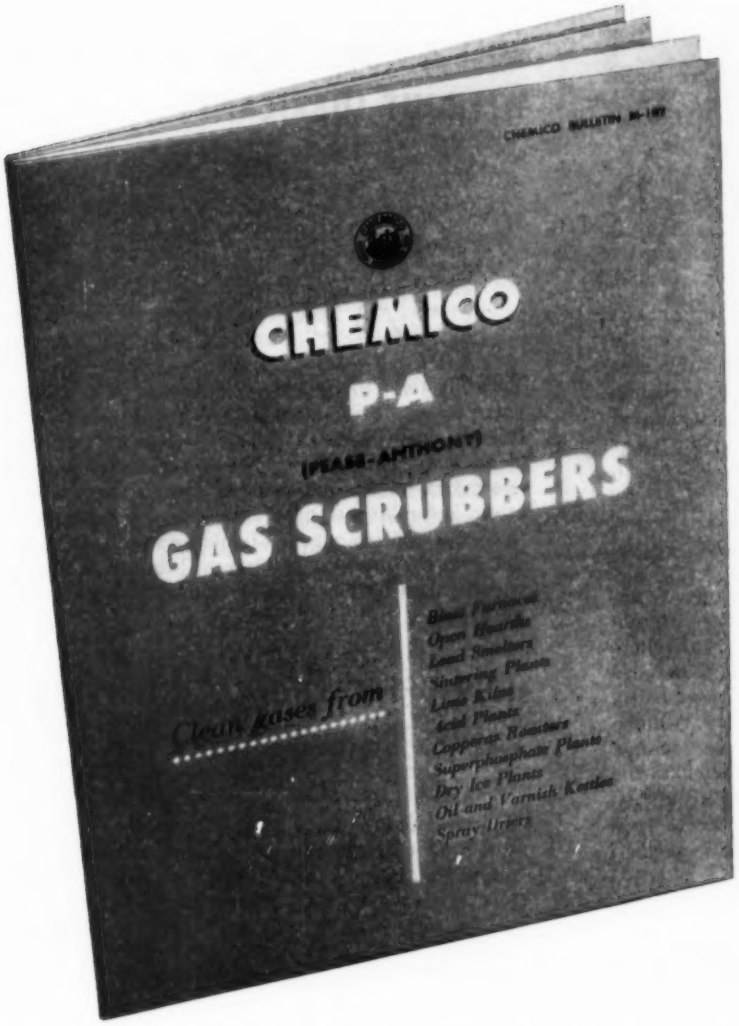
High Gas Scrubbing Efficiency
AT LOW COST!



This Chemico bulletin contains factual information on the two types of Chemico P-A Gas Scrubbers. Both scrubbers offer high collection efficiency at low cost. Both are now being successfully used in a wide range of industries.

The bulletin gives performance data on the *P-A Venturi Scrubber* that effectively and economically removes sub-micron dusts, fumes and mists from industrial gases, and the *P-A Cyclonic Scrubber* for the removal of micron-size dusts from gas streams. If you have a gas scrubbing problem, write us detailing your specific requirements.

Phone (MU-8-7400) or write our P-A Sales Dept. for further information and ask for our Bulletin M-102 on P-A Gas Scrubbers.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

Technical Representatives Throughout the World • Cables: Chemiconst, New York.

Chemico plants are profitable investments

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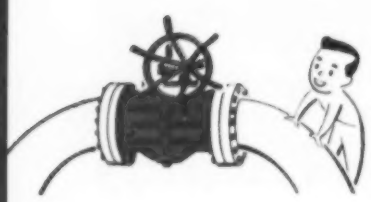
Let's Face the Facts . . .

DOES VALVE LUBRICATION

Now and then someone revives an old argument—"it costs too much to maintain lubricated valves."

On the surface, that sounds logical. But if that really was a fact, millions of Nordstrom lubricated valves in service today could never have been sold.*

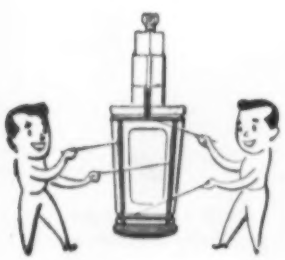
WHAT IS THE ADVANTAGE OF A LUBRICATED VALVE?



The most important function of lubricant in a Nordstrom valve is to give a tighter seal than can be accomplished through any other method yet developed. The thin film of plastic lubricant that is forced around the ports of the plug is a pressure seal in itself.

Of course, the lubricant has other obvious advantages—the same advantages it has in your automobile, or in any other mechanical equipment where metal rubs metal. The lubricant all but eliminates the possibility of galling or seizing, and consequently keeps the valve ready to operate in a hurry. A lubricated Nordstrom valve operates easily even against high line pressures, because the plug turns *within* the line, rather than being forced or wedged *against* it. Since it takes only a quarter turn of the plug to open or close the valve, it operates in seconds instead of minutes.

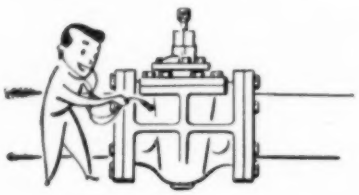
WHAT DOES THE LUBRICANT DO?



In a Nordstrom valve, lubricant is forced through a series of grooves surrounding the plug ports. There it acts as an extra seal against the little leaks that become big problems. It is also forced into a lubricant chamber at the small end of the plug where it serves as a hydraulic jack to keep the plug easy to turn.

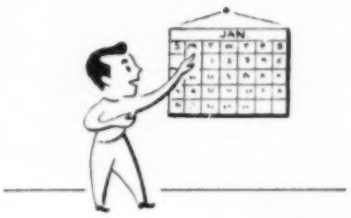
Finally, it *lubricates* . . that is, it prevents grinding wear, fills tiny imperfections that may develop, and it lets the plug slide without grating.

WILL A NORDSTROM VALVE WORK WITHOUT LUBRICANT?



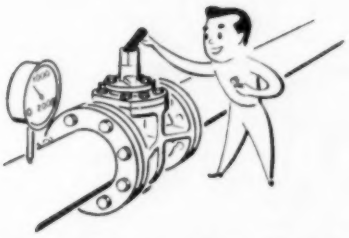
Yes, but then the whole advantage of a lubricated valve is lost. Your car will also operate without lubricant, but with proper lubricant, it is far more efficient, lasts many, many times longer, needs much less maintenance, and is safer. So is a valve. Nordstrom is fundamentally a valve—a plug valve made to exceptional standards of tolerance and quality—but it is the internal Nordstrom lubrication system which raises its performance standards above ordinary valves.

HOW OFTEN SHOULD NORDSTROM VALVES BE LUBRICATED?



Like your car, that depends upon the service—the temperature, process, frequency of operation, etc. It's hard to generalize, but your Nordstrom sales engineer can advise you. Using Rockwell lubricants, made especially for Nordstrom valves, is one way to reduce frequency of lubrication in many cases. Also, Rockwell markets mechanical lubrication equipment to make scheduled lubrication easy. Nordstrom Hypreseal valves are now built with an external fitting so that it is unnecessary to remove any parts from the valve before lubrication.

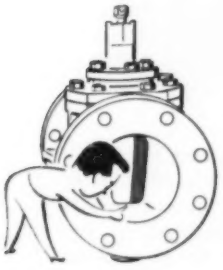
COST MONEY OR SAVE MONEY?



WHAT LUBRICANTS SHOULD BE USED?

Part of the effect of lubricating your car is lost if you use improper lubricants. That is also true of lubricated valves. Genuine Rockwell lubricants will save you money—they are the result of the longest and most extensive research into valve lubricants by any company. They are the result of years of field experience with nearly every process condition. For many services there are variations of Rockwell lubricants compounded to offset specific line conditions. Also, for many services Rockwell Hypermatic lubricant may be recommended. This lubricant, which is compressible and energizable, regenerates itself in the lubrication system, greatly reducing lubrication frequency. In any case, consult your Nordstrom sales engineer.

HOW LONG WILL PROPERLY LUBRICATED NORDSTROM VALVES LAST?



That's impossible to answer, since many of the first Nordstrom valves put into regular service are still going strong. The service has a lot to do with it, naturally. In gas service, there are many valves with more than 30 years service. In the valve-killing application of drilling rig mudlines, Nordstrom valves have been disassembled for inspection after more than 150,000 feet of hole on many occasions, found to be without wear, and returned for more service—often four times the life of ordinary valves. In a two-year paint plant test, Nordstrom valves were the only ones that did not need to be replaced because of leakage. Nordstrom files are full of such authentic field case histories—ask your Nordstrom sales engineer.

WHAT ABOUT MAINTENANCE COSTS FOR NON-LUBRICATED VALVES?

In any but the most simple services, any kind of valves need *some* maintenance. But in the case of Nordstrom valves, maintenance is generally confined to adding lubricant at intervals. Over a 20-year period, Nordstrom sales of repair parts have been less than half of one per cent of sales. In several plants in which records were kept and where Nordstrom and other valves were used, repair parts for Nordstrom valves ran about one-tenth of other makes.

The analogy to your car carries over here—if you don't lubricate it, you save on lubricant, but pay the far, far higher costs of part replacement. And more particularly, you'll need a new car much more often.

When you consider valve maintenance, be sure to count *all* the costs—not just simple service, but major repairs and complete replacement costs, shutdowns, extra labor to operate, and *all* factors.

If you do, if yours is a typical application, you'll find that year-in and year-out, the most economical valves you can use are Nordstroms.

If you'd like to discuss the suitability of Nordstrom valves for any service, let us know. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Ltd.

ROCKWELL-Nordstrom VALVES

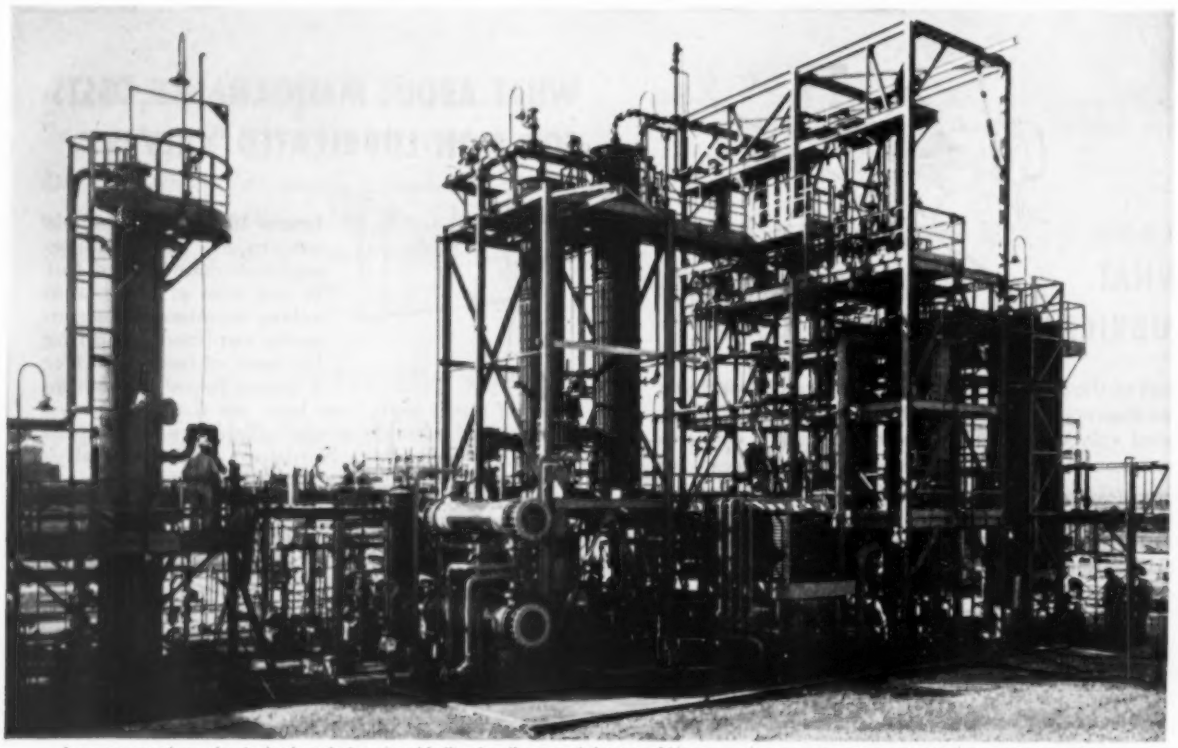
Lubricant-Sealed for Positive Shut-Off

* Nordstrom invented lubricated valves more than 30 years ago. Since that time, several million have been installed in hundreds of widely varied petroleum, gas, chemical and other process services. With by far the most complete range of sizes and pressures, and many patents on construction details, Nordstrom is the leader in lubricated valves.

WHERE HAVEG EQUIPMENT IS INSTALLED

TRADE MARK REG. U. S. PAT. OFF.

PIPING • VALVES • FITTINGS • PRESSURE PROCESS TANKS • ABSORBERS AND SCRUBBERS
HEAT EXCHANGERS • FUME DUCT • PUMPS • VACUUM JETS AND CONDENSERS



A recent petroleum chemicals plant designed and built primarily around the use of Haveg—a basic construction material that resists corrosion.

Petro-Chemical Corrosion has been Controlled!

Now for designers and engineers of petro-chemical plants there is an old and proven basic material of construction, borrowed from its 22 years of service in the chemical and metallurgical industries. It is Haveg, a plastic molded in the form of finished process equipment, or available for many types of field fabrication. Made from acid-digested asbestos and special thermosetting resins, Haveg enables you to go into a high range of process temperatures with complete safety and a proven history of outstanding performance.

Haveg has three great virtues. It is completely resistant to most corrosion. It lasts for years. It is amazingly versatile.

Not a coating or lining, Haveg gives resistance to corrosion through its entire mass, never allowing corrosives an opening wedge from cracks. It resists thermal shock, seldom requires insulation.

From steel-jacketed pressure process tanks down to the last piece of pipe, many of the petro-chemical processes can be completely contained and kept free from corrosion. Unnecessary maintenance, controls, headaches are avoided. Should plans or processes change, Haveg equipment can be machined and altered by your men, on the job. Accidental mechanical damage is easily repaired, using Haveg cement. Full chemical resistance is maintained.

If your job is fighting corrosion, get a helping hand from Haveg. Call the experienced sales engineer listed. Write for the 64-page illustrated Bulletin F-6 which contains size and chemical resistance charts, design specifications. Remember, Haveg is a logical answer to your design problems in handling petro-chemicals; in fact, in all process equipment that must handle corrosives.

ATLANTA, Exchange 3821 • CHICAGO 11, Delaware 7-6088
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LOS ANGELES 14, Mutual 1105 • SEATTLE 7, Hemlock 1351
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HAVEG CORPORATION
NEWARK 4, DELAWARE

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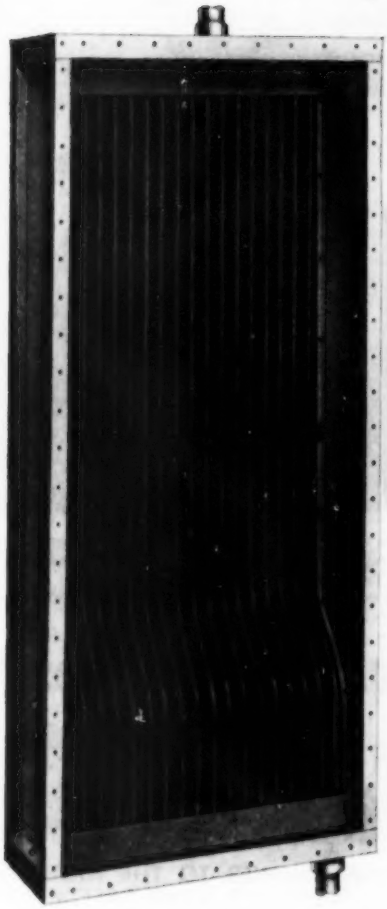
FACTORY: WILMINGTON 8, DEL. • Wilmington 3-8884

A SUBSIDIARY OF CONTINENTAL-DIAMOND FIBRE CO.

EFFICIENT *Extended-Surface* HEAT EXCHANGERS



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Heating
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Process
Air Conditioning

Aerofin is sold only by manufacturers of fan-system apparatus. List on request.

ASK THE AEROFIN MAN

Your Aerofin man's recommendation means high efficiency, long service life, low maintenance costs.

Aerofin's unequalled laboratory and manufacturing facilities — unequalled knowledge of heat-exchange practice — are devoted exclusively to the design and manufacture of highest quality extended heat surface.

AEROFIN CORPORATION
101 Greenway Ave., Syracuse 1, N. Y.

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A.O.Smith for

VESSELS

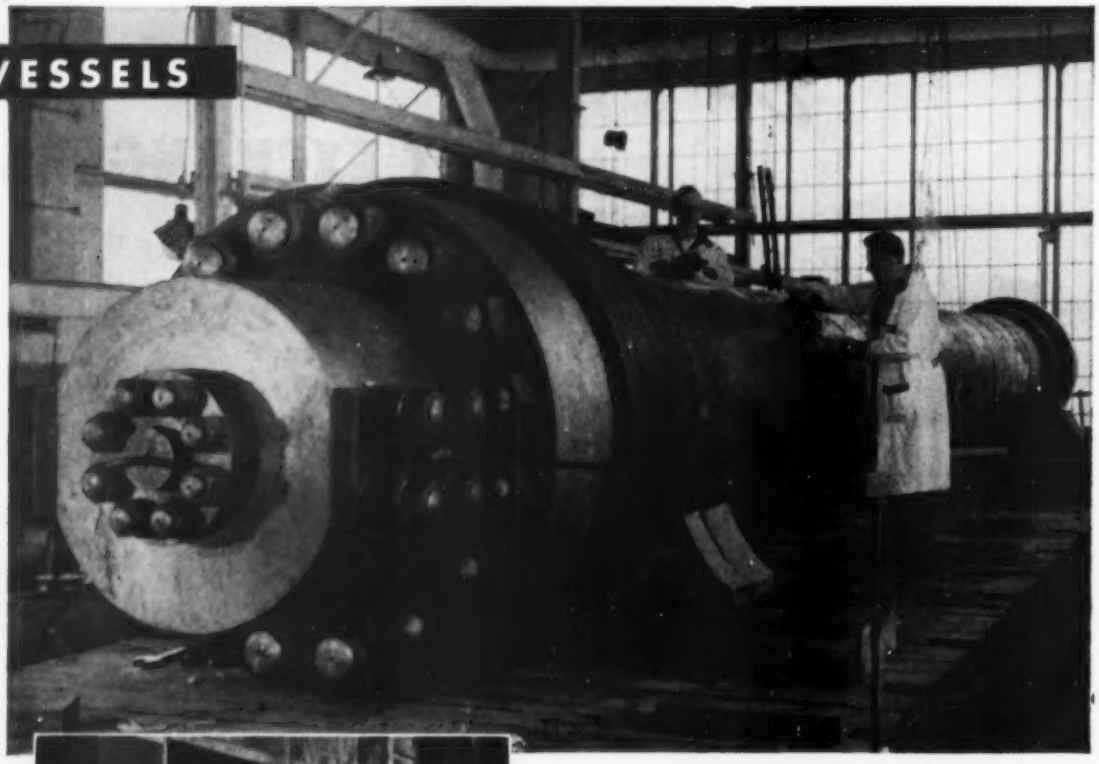


Photo shows MULTI-LAYER ammonia super-pressure converter on test at A. O. Smith. Inside vessel diameter is 25¾ in. . . . length from one flange face to the other is 44 ft. 3 in. . . . weight 238,000 lbs. Vessel is designed for operating pressures of 12,500 psi at a temperature of 450° F.

A. O. Smith technician checks gauges on converter undergoing pressure tests. The giant vessel is being tested out at 18,750 psi.

If your process involves high

DESIGN

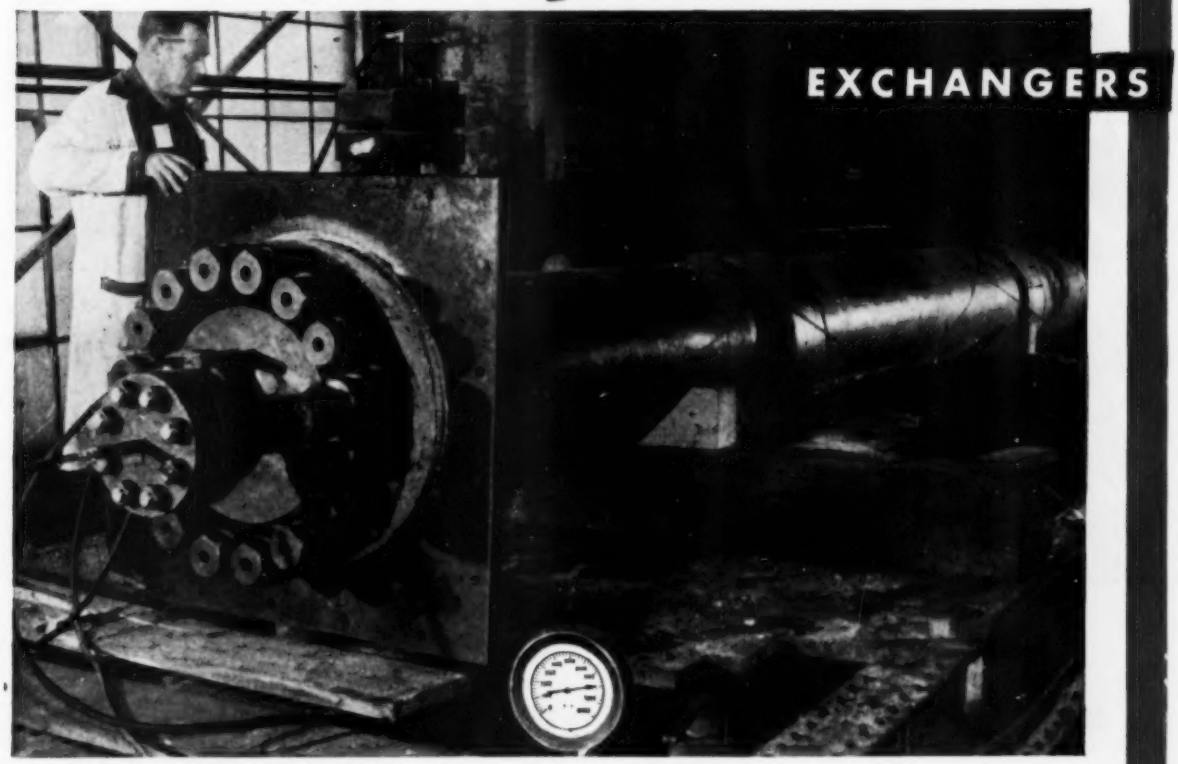
THE ANSWER TO THE HIGHER PRESSURES WITH SAFETY

A. O. SMITH MULTI-LAYER construction offers significant advantages to the men who operate plants or design equipment for the processing industries. Today . . . right now . . . they can design for the higher pressures that will be required in the future.

In MULTI-LAYER construction, successive concentric layers of relatively thin steel plate are wrapped and welded around a central pressure-tight cylinder. There's no limitation of size or weight . . . no restrictions imposed by ingot size or forming techniques. The variations are endless.

Positive safety under pressure, too! By testing to destruction full-scale vessels at pressures in excess of

Outstanding Advantages



Here's a Multi-LAYER recycle heat exchanger undergoing test pressure of 7,920 psi. Inside diameter is 17 in. . . . MULTI-LAYER wall thickness is 3⅜ in. . . . overall length 29 ft. 2 in. Weighing 31,200 lbs., this exchanger is designed for shell-side operating pressures of 5,280 psi.

pressures, high temperatures or corrosive materials,

WITH MULTI-LAYER

40,000 psi, A. O. Smith has proved that MULTI-LAYER vessels burst without fragmentation.

Pick the alloy lining required to fit your needs! MULTI-LAYER vessels can be fabricated with inner cylinder of lined or clad plate, alloy steel or non-ferrous materials. The outer layers of the vessel can then be fabricated of high strength steel to resist the pressure loads.

Let A. O. Smith engineering and research help you adapt MULTI-LAYER vessels and heat exchangers to your operation.

Write for free bulletins: "MULTI-LAYER Manufacturing and Assembling" . . . "MULTI-LAYER Engineering for Safety."

Through research A.O. Smith *. . . a better way*

A.O.Smith
CORPORATION

PROCESS EQUIPMENT DIVISION
International Division: Milwaukee 1, Wis.
MILWAUKEE • HOUSTON • LOS ANGELES

For glass-lined process equipment, contact GLASCOTE PRODUCTS, INC., Cleveland 17, Ohio — A new A. O. Smith Subsidiary

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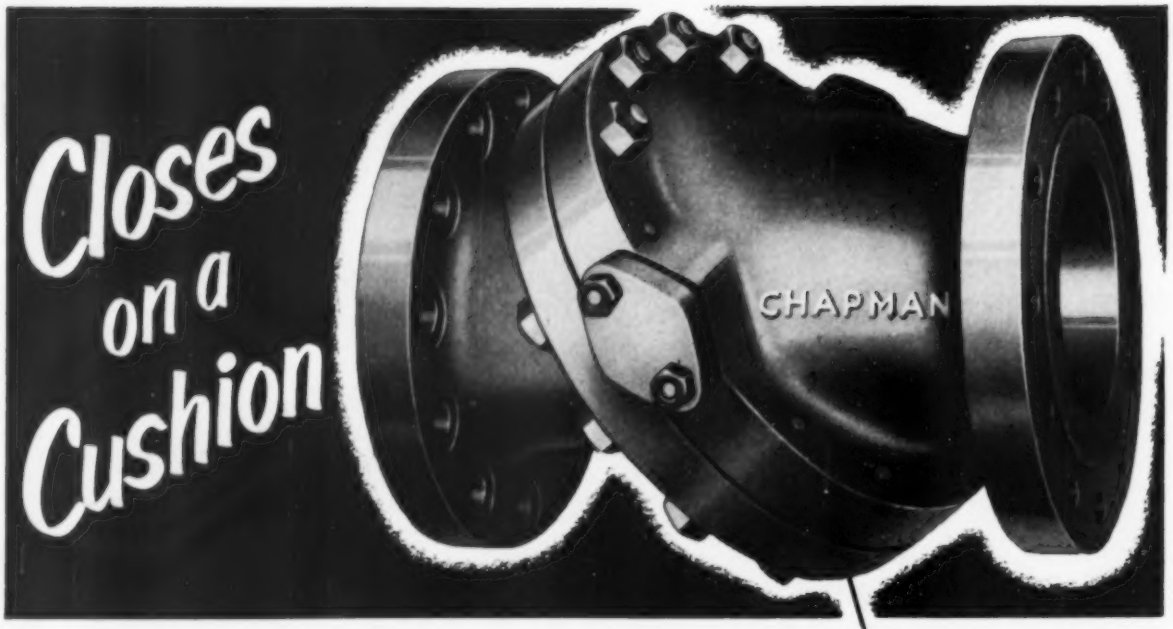
Chapman's Tilting Disc Check Valve

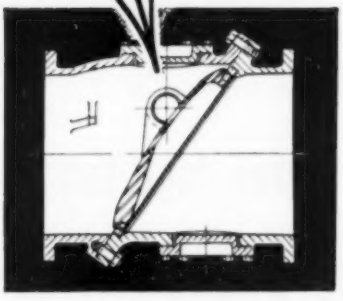


...for low cost, slam-free operation

Balanced pressures *cushion* the movement of the disc in Chapman's Tilting Disc Check Valve. The valve closes quickly but quietly, in all but unusual piping arrangements. There's no slamming to damage pipe-line joints or the valve itself. And *drop-tight* closure eliminates sliding wear on the disc and seat.

In the open position, the "airfoil" designed disc rides firmly against stops, without swinging or fluttering. That's why the hardened extra-large hinge pins give extremely long wear. And the absence of turbulence is one reason why head loss through Chapman's Tilting Disc Check Valve is lower than through any other type of check valve.

Low head loss, increased wear resistance and freedom from destructive slamming make Chapman's Tilting Disc Check Valves unbeatable for almost every installation. Write for Catalog No. 30 today.



Here's why
CHAPMAN Tilting Disc Check Valves
***Keep Quiet* All Their Lives**

This specially designed "airfoil" disc balances perfectly in open position . . . then drops easily to closed position (cushioned by the flow). No jarring or slamming, in usual pipe-layouts. Write for bulletin.

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

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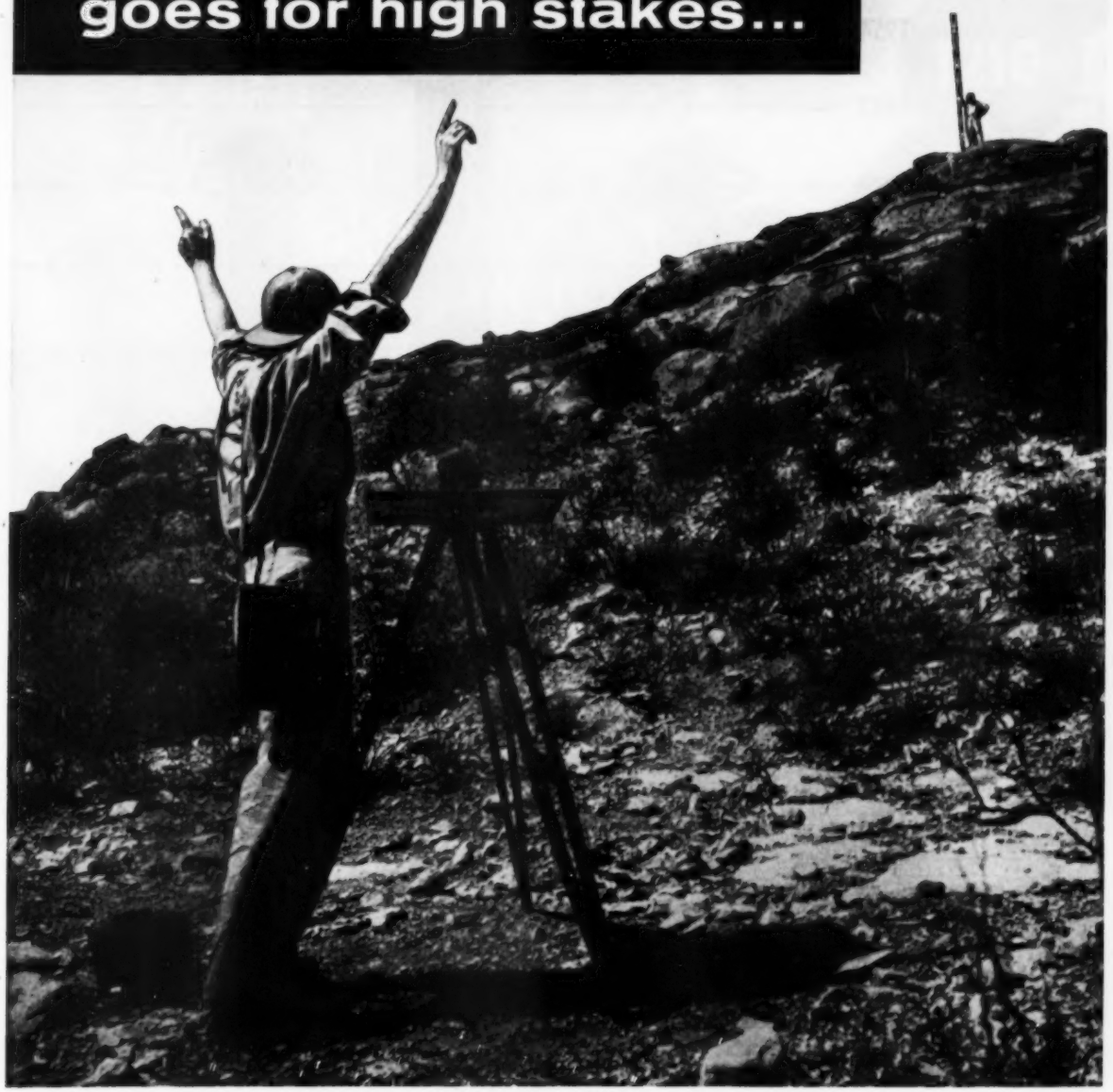
Cities Service goes for high stakes...



Test wells are put down on an average of one every 4 days by

CITIES SERVICE

A Growth Company

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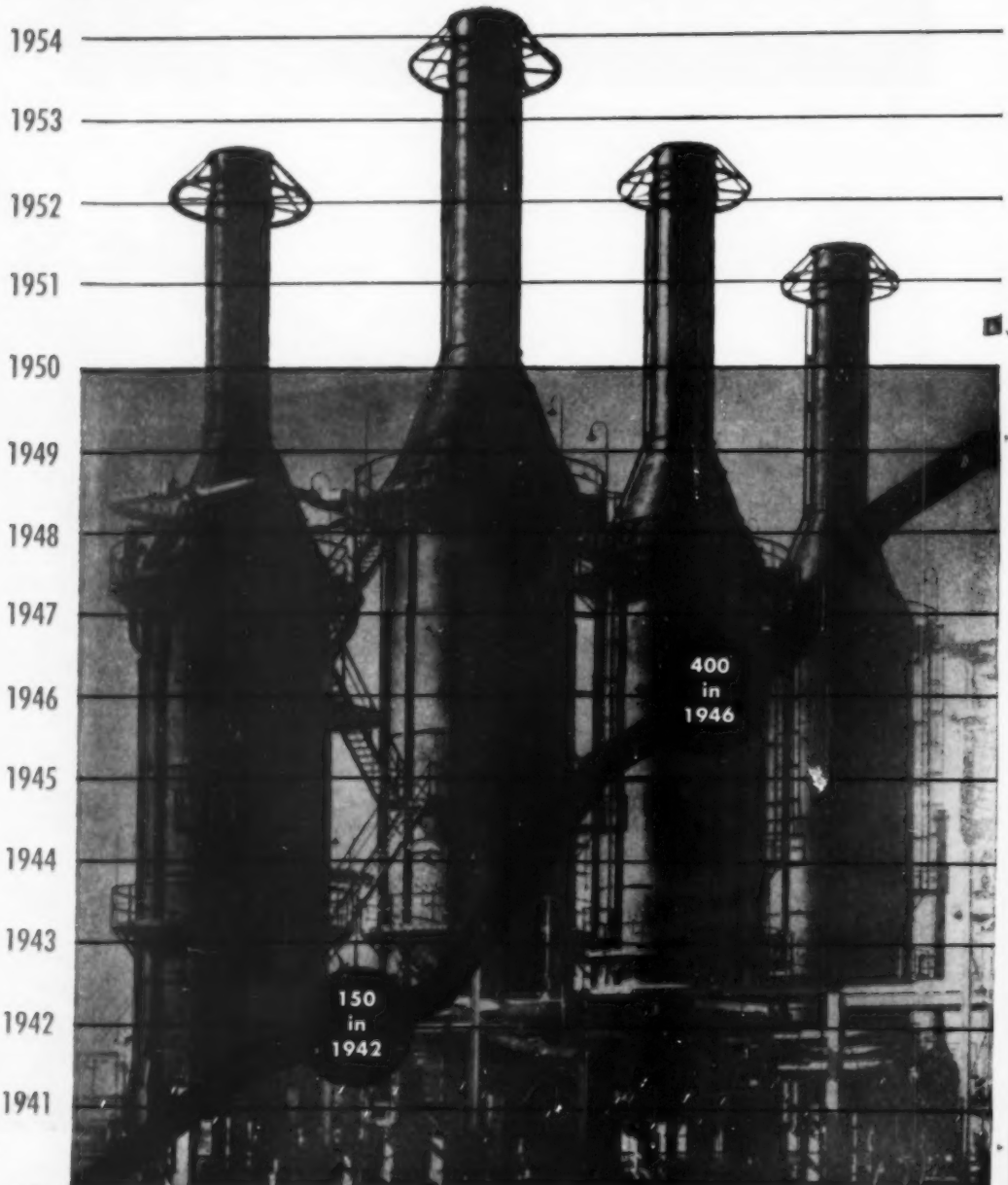
1210 PETROCHEM-ISOFLOW

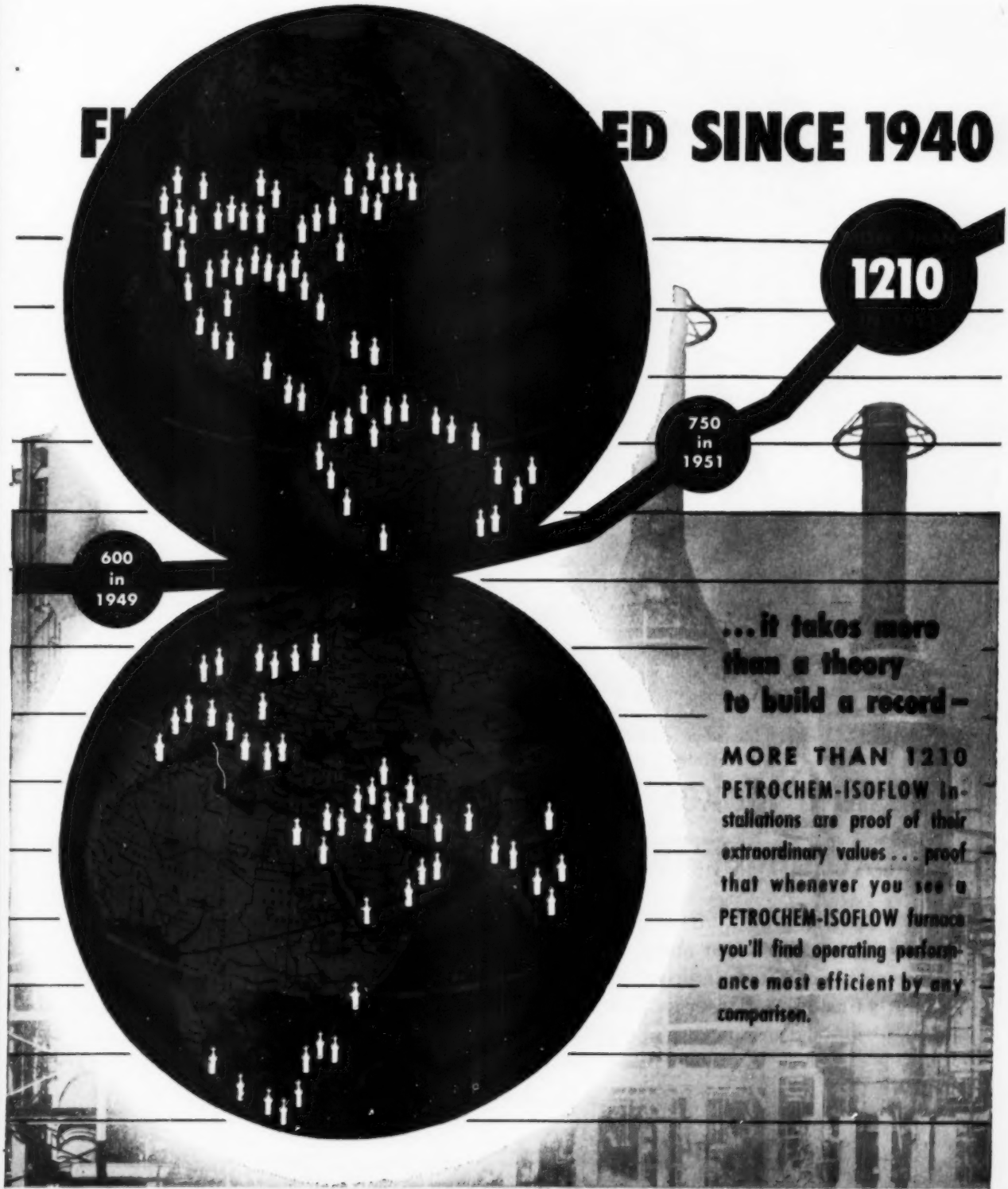


in 1940 there was . . . 1
in 1944 there were . . . 215
in 1948 there were . . . 500
and as of today
there are more than 1210

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

F ED SINCE 1940



...it takes more than a theory to build a record—

MORE THAN 1210 PETROCHEM-ISOFLOW installations are proof of their extraordinary values... proof that whenever you see a PETROCHEM-ISOFLOW furnace you'll find operating performance most efficient by any comparison.

PETRO-CHEM DEVELOPMENT CO., INCORPORATED 122 East 42nd St., New York 17, N. Y.

Representatives: Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh • Faville-Levally, Chicago • Lester Oberholtz, Los Angeles • Gordon D. Hardin, Louisville • Turbex Equipment Co., Narberth, Pa.

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His testing makes CHASE® Antimonial Admiralty Heat Exchanger Tubes the *best you can buy!*

TOUGH is the word for the Chase Expansion Test pictured above. A pin with a 1½" per ft. taper is driven into the end of a Chase Heat Exchanger Tube which must withstand an increase of *20% in diameter.*

This test is just one of many that Chase Tubes must pass.

Chase *ANTIMONIAL ADMIRALTY* Tubes must pass far sterner tests in the Chase Laboratories than they will ever encounter under normal tube usage. That's why they last for years in actual use. It pays to insist on Chase.

CHASE WAREHOUSE STOCKS: Houston,* Los Angeles, New Orleans, Tulsa**

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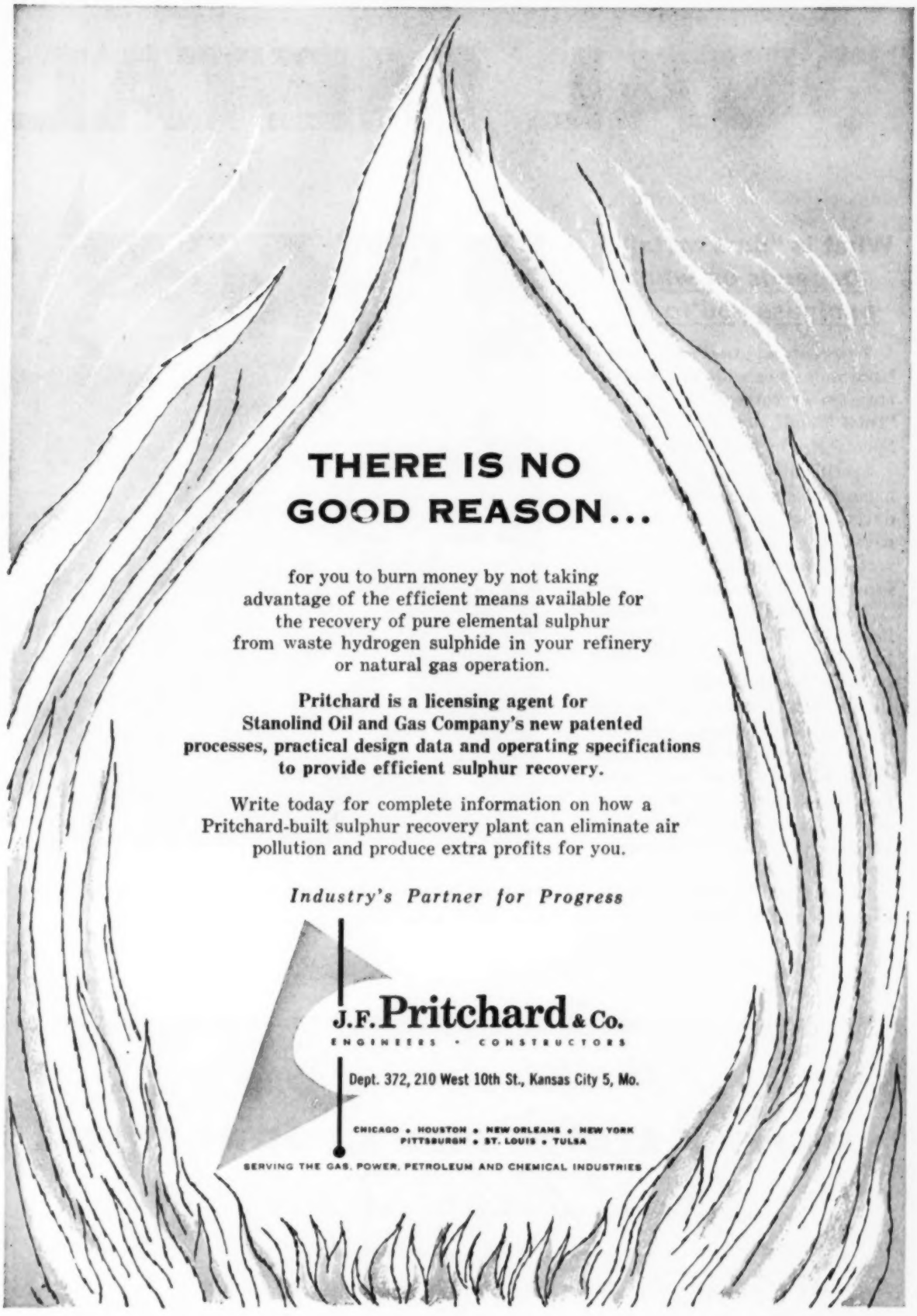
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GOOD REASON...
for you to burn money by not taking
advantage of the efficient means available for
the recovery of pure elemental sulphur
from waste hydrogen sulphide in your refinery
or natural gas operation.
Pritchard is a licensing agent for
Stanolind Oil and Gas Company's new patented
processes, practical design data and operating specifications
to provide efficient sulphur recovery.
Write today for complete information on how a
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SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES

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DUAL METAL

What is "dual metal"?
Depends on what business you're in!

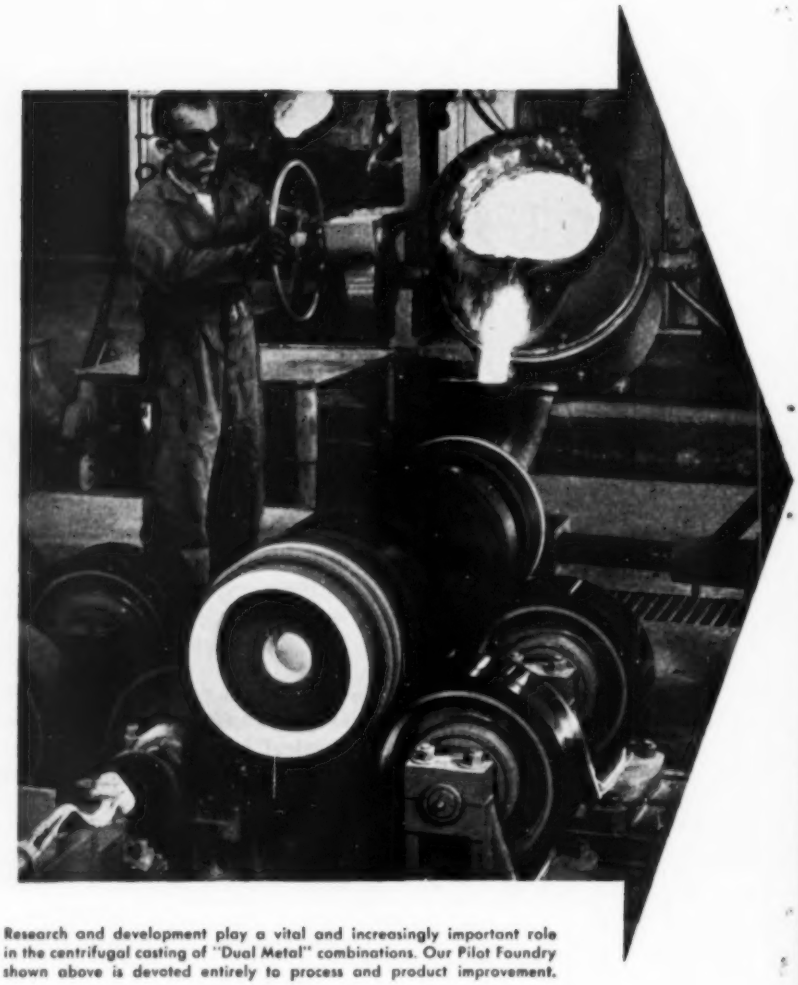
To twenty of America's largest basic industries with problems of abrasion or corrosion—or both—"Dual Metal" means U. S. Pipe's Special Products Division.

Specifically, "Dual Metal" is our name for centrifugally cast cylindrical sections in which two dissimilar metals are bonded metallurgically by centrifugal force and temperature.

"Dual Metal" centrifugally cast, integrally fused combinations of two dissimilar metals are doing industry's most difficult and exacting jobs better and more economically than ever before.

Design engineers have been quick to recognize the outstanding merits of a process capable of combining the desired mechanical and chemical properties no single metal possesses.

"Dual Metal" means versatility, efficiency and economy.



Research and development play a vital and increasingly important role in the centrifugal casting of "Dual Metal" combinations. Our Pilot Foundry shown above is devoted entirely to process and product improvement.

UNITED STATES PIPE & FOUNDRY CO.

Special Products Division

BURLINGTON, NEW JERSEY

SALES OFFICES: LOS ANGELES, CHICAGO, ST. LOUIS, CLEVELAND, DETROIT, PITTSBURGH, BURLINGTON

NEW ANSWER TO AN OLD REFINING PROBLEM

less abrasion...longer wear

"Dual Metal" solves one of the petroleum industry's most severe and costly problems—catalyst erosion of lift pipe and catalyst handling lines.

In making a "Dual Metal" lift pipe the outer shell of weldable alloy steel is poured into a rapidly rotating mold. The abrasion-resistant alloy iron core is introduced into a spinning mold at the proper time and temperature. Result? A metallurgically bonded two-metal structure that combines the strength and weldability of low alloy steel and the superior abrasion resistance of alloy iron.

"Dual Metal" lift pipes now in use in 33 of the nation's leading refineries show encouraging evidence of much longer life. In one typical refinery periodic examinations of high temperature catalyst pipes have indicated abrasion resistance of better than 16 to 1 over conventional steel piping. A once-troublesome bottleneck in processing has been eliminated and refinery operations made more efficient and economical.

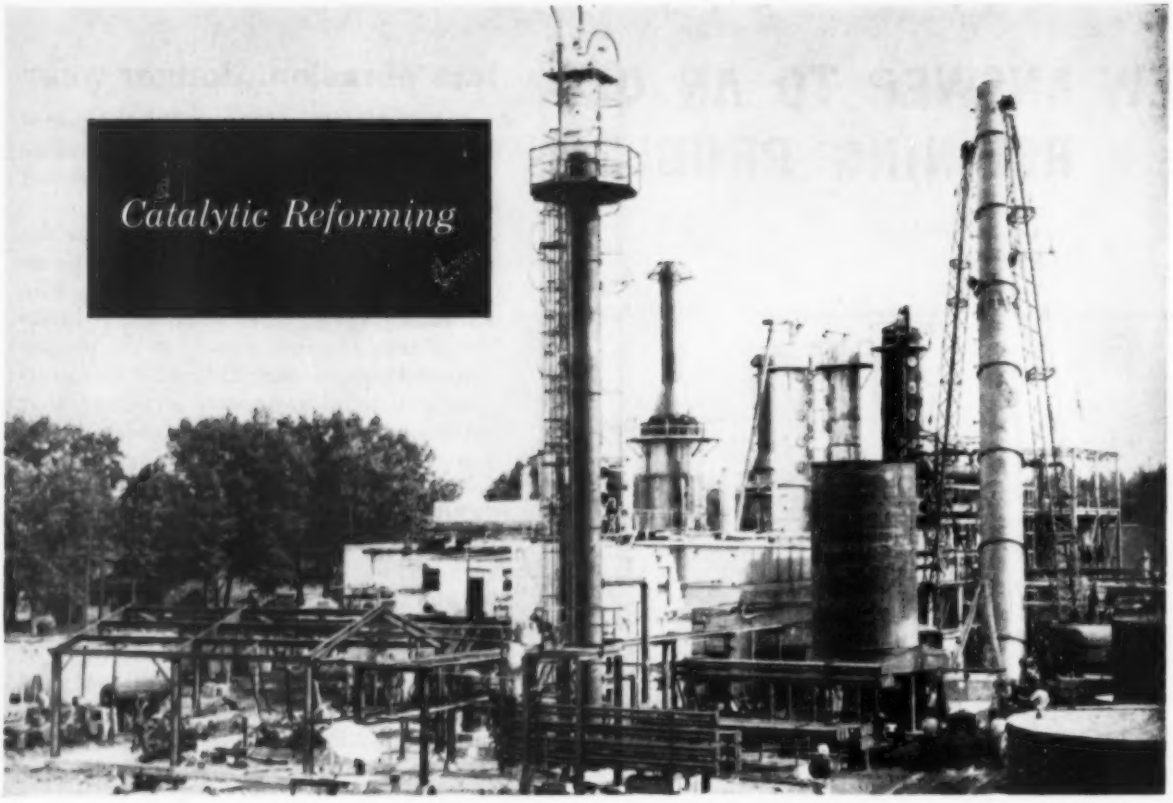
Perhaps this versatile process is the answer to your particular problem. Write today for specific literature and information on "Dual Metal" applications for the refining industry.

"DUAL METAL" CENTRIFUGAL CASTINGS

SIZE RANGES

Outside Diameter	6" to 36"
Wall Thickness	½" and up
Length	Up to 14' without welding

Typical Oil Industry Applications: Catalyst Lift Pipe, Depressurizing Pipe, Catalyst Transfer Lines, Slush Pump Liners, Valve Nozzles, etc.



Naph-Sol Refining Company, Muskegon, Michigan . . .
UOP Platformer, during final phase of construction

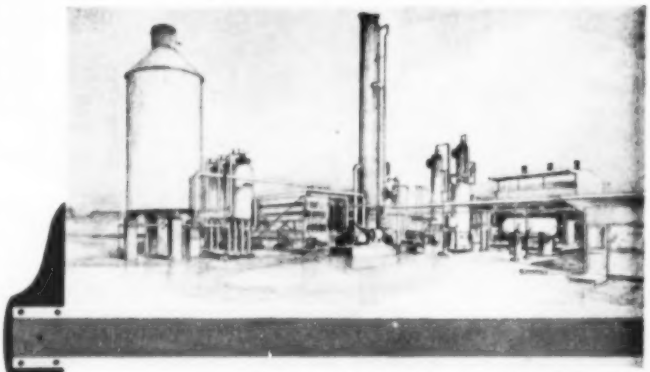
From contract to capacity in 6½ months

Fast but *good* . . . that's what SWECO promised when Naph-Sol decided to enter the high octane race with a SWECO-constructed Catalytic Reforming Plant. In record time, the plant is ready to produce 1,000 barrels per day of high octane gasoline.

SWECO service is *fast* because engineering . . . equipment fabrication and delivery . . . are rigidly coordinated with erection work at the plant site. Experience in our own extensive fabricating shops helps iron out timing problems, whether equipment is made by us or procured from outside suppliers. Close coordination of shop and field work results in substantial economies in both time and money.

Our reputation for doing a *good* job is backed up by 30 years of engineering and construction service. Each job is closely supervised by top home-office and field engineers. Every phase of construction meets the exacting requirements of the process developer.

SWECO is licensed to build the leading types of Catalytic Reforming and other petroleum processes. If you are planning a new plant or modernization of your present facilities, it will pay you to consult SWECO.



Close coordination of engineering, shop work, procurement and field erection resulted in record construction of recently completed Naph-Sol plant depicted above.

SWECO

Southwestern Engineering Corporation

Engineers and Constructors
. . . Manufacturers
Serving the process industries

4800 Santa Fe Avenue
Los Angeles 58, Calif. Dept. PR-104
LOgan 8-6262
Cable Address: SWECOLA

SWECO PRODUCTS

Heat Exchangers

Custom fabrication of all types of steel and special alloy vessels for the process industries.

Screen Separators.

For more data on advertised products, use Readers' Service Cards, last page.

THROUGHOUT THE REFINERY...

SPECIAL INDUSTRIAL CONCRETES

- Save Time
- Cut Costs
- Improve Efficiency

This Kellogg Orthoflow fluid catalytic cracking unit at The Atlantic Refining Co.'s Point Breeze, Philadelphia, Pa., plant, is lined with refractory-insulating concrete.

Concretes made with Lumnite* resist heat... resist corrosion...and insulate

Special industrial concretes made with Lumnite calcium-aluminate cement solve many refinery problems. They provide the placing convenience and structural advantages of regular concrete plus three big extras — resistance to high temperatures ...corrosion...*and they insulate, too.*

These special industrial concretes can be made to withstand temperatures up to 2600°F. Their unique properties often permit you to specify one concrete for many difficult jobs throughout the refinery.

Easily made, by combining Lumnite cement with suitable aggregates, these concretes can be placed quickly — by cement gun, plastering or pouring. Construction or repair work goes rapidly . . . reaches service strength in less than 24 hours. Production losses are cut to a minimum.

For convenience, many use prepared castables (packaged mixes of Lumnite cement and aggregates selected for specific temperature and insulation needs — add only water). They're made and distributed by refractory manufacturers. For more information write Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

USE SPECIAL INDUSTRIAL CONCRETES FOR

1. **REFRACTORY-INSULATING CONCRETE** — in strippers, rerun chambers, reactors, regenerators, fractional distillation and thermal alkylation units.
2. **ABRASION-RESISTANT REFRACTORY CONCRETE** — Catalyst transfer and discharge lines, reforming chambers, gas coolers, reactor cyclones and transfer lines, regenerator cyclones and returner lines.
3. **REFRACTORY CONCRETE** — in bubble and flash towers, continuous-pressure stills.
4. **CORROSION-RESISTANT AND REFRACTORY-INSULATING CONCRETE** — linings in regenerator exhaust, lines, stacks, ducts.
5. **CORROSION-RESISTANT CONCRETE** — in linings for sweetening and storage tanks, waste-disposal systems, and trenches.

OFFICES: *Albany, Birmingham, Boston, Chicago, Dayton, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.*

"LUMNITE" is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.

PR-L-95

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

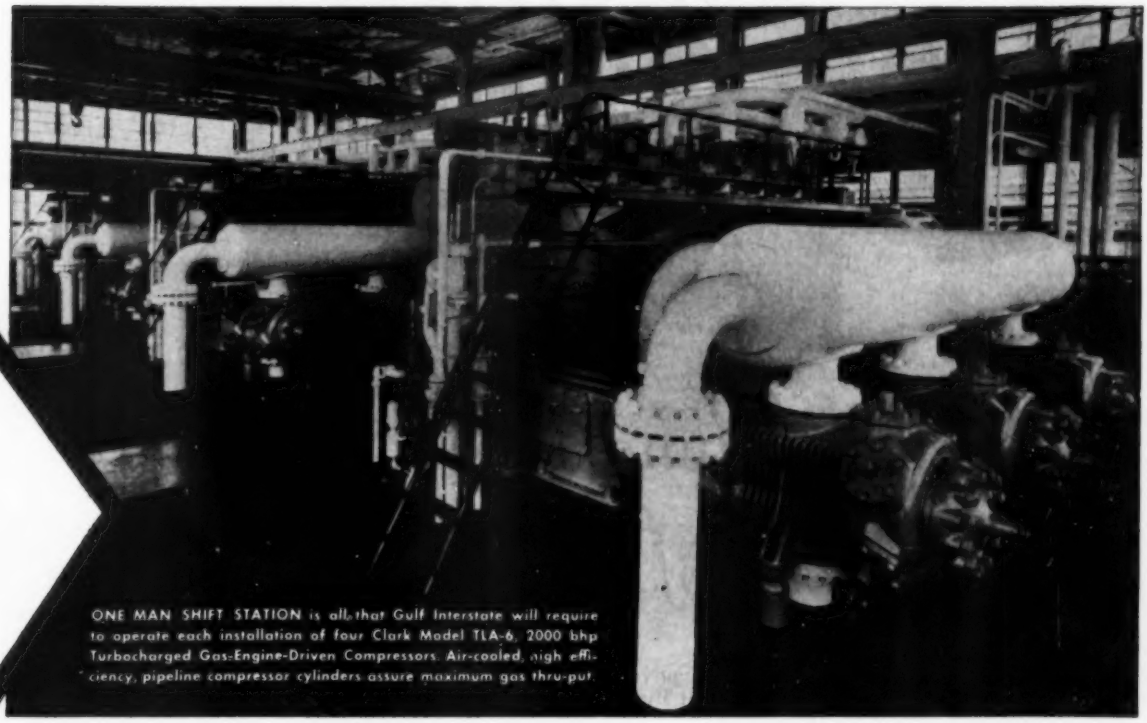
UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station.

For more data on advertised products, use Readers' Service Cards, last page.

Here's the pattern for gas transmission pipeline compressor stations of the future!

NEW GULF INTERSTATE SYSTEM

Selects the Clark Turbocharged Model TLA-6 for its Automatic, Push-Button Operated Stations



ONE MAN SHIFT STATION is all that Gulf Interstate will require to operate each installation of four Clark Model TLA-6, 2000 bhp Turbocharged Gas-Engine-Driven Compressors. Air-cooled, high efficiency, pipeline compressor cylinders assure maximum gas thru-put.

It's already an accepted fact that the Gulf Interstate Gas Company has changed the pattern for natural gas transmission with its one man, push-button controlled, automatic compressor stations.

With such advanced thinking, it's only natural that Gulf Interstate will be the first to use the NEW Clark Model TLA, 2000 bhp, Turbocharged Compressors in conjunction with their newly developed system of controls.

Gulf Interstate's control devices for automatic operation of these Clark Compressors did not appreciably increase the installed cost.

If you're interested in a compressor station that can be operated with the highest possible efficiency — *automatically* — while still maintaining station-loading flexibility, be sure you investigate Clark Models TRA and TLA Compressors. There are 8 sizes in a range of 825-3300 bhp. Ask your nearest Clark representative for Bulletins 130 and 134.

CLARK BROS. CO. • OLEAN, N. Y.
ONE OF THE DRESSER INDUSTRIES
Sales Offices in Principal Cities Throughout the World

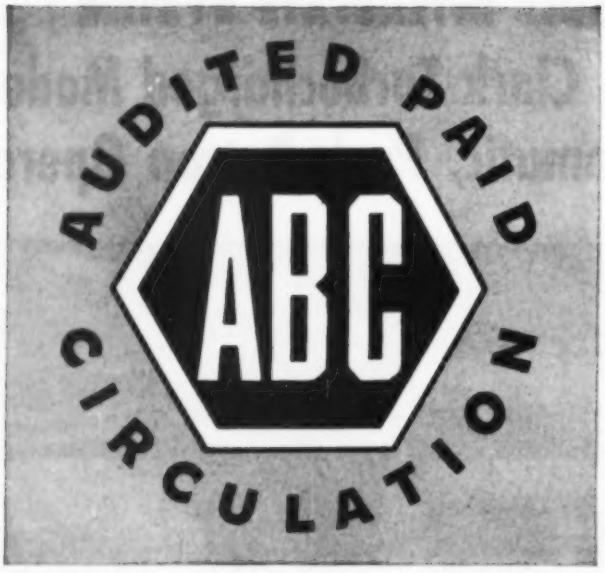
A dozen ways you'll be ahead with Clark TLA's

- 7000 btu/bhp/h fuel consumption.
- 40% less cooling required.
- 25-30% lower installation cost.
- Drastic reduction in number of moving parts.
- 90% engine mechanical efficiency.
- Detonation-free operation under all climatic conditions.
- Generous temporary overload capacity.
- Specifically designed for turbocharging.
- Low cycle temperatures for maximum cylinder and ring life.
- Only one turbocharger per unit.
- Unapproached for accessibility.
- 2-cycle simplicity, dependability.

CLARK compressors

Clark sets the pace in compressor progress

For more data on advertised products, use Readers' Service Cards, last page.



The Hallmark of Circulation Value

Three thousand four hundred and fifty advertiser, agency and publisher members of the Audit Bureau of Circulations have a voice in establishing and maintaining the standards responsible for the recognition of this emblem as the Hallmark of Circulation Value. It represents the standard of value that these buyers and sellers of advertising space have jointly established as measurement for the circulation of printed media.

The basis for arriving at the advertising value of a publication is the Bureau's single definition of net paid circulation. With this as the standard, the circulation records of A.B.C. publisher members are audited by experienced circulation auditors. As specified in the Bureau's Bylaws, A.B.C. auditors have "access to all books and records."

Subscription and renewal orders, payments from subscribers, paper purchases, postal receipts, arrears are among the publisher's circulation records that are painstakingly checked by auditors and the resulting data are condensed and published in A.B.C. Reports.

Experienced space buyers use the audited information in A.B.C. Reports as a factual basis for their decisions in evaluating, comparing and selecting media. The FACTS in A.B.C. Reports for business publications include: • How much paid circulation • How much unpaid distribution • Occupational or business breakdown of subscribers • Where they are located • How much subscribers pay • Whether or not premiums are used • How many subscribers in arrears • What percentage of subscribers renew.

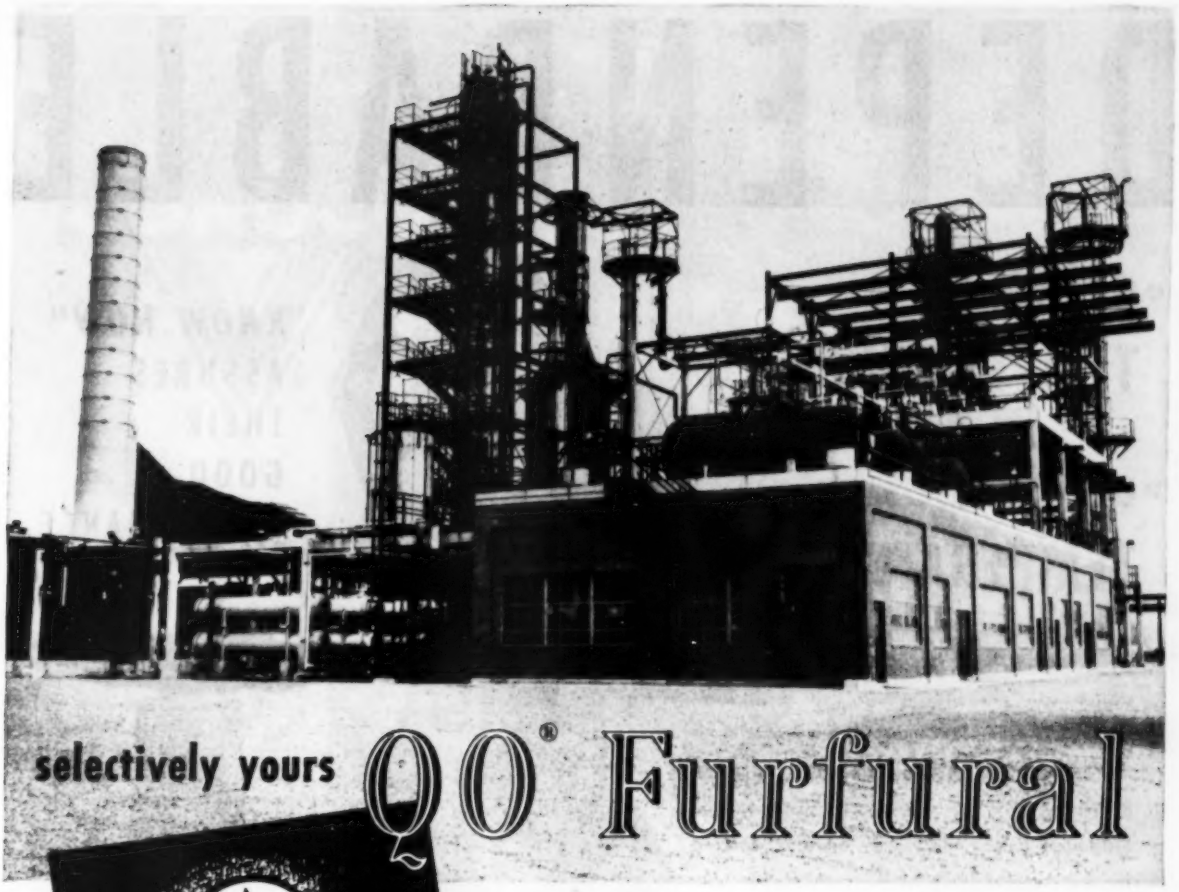
This publication is a member of the Audit Bureau of Circulations and is proud to display the Hallmark of Circulation Value as the emblem of our cooperation with advertisers. Ask for a copy of our A.B.C. Report and then study it.

SEND THE RIGHT MESSAGE TO THE RIGHT PEOPLE

Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.

PETROLEUM REFINER

A.B.C. REPORTS—FACTS AS A BASIC MEASURE OF ADVERTISING VALUE



selectively yours QO® Furfural

TEXACO

Effective use of furfural for refining gas oil, diesel fuel, and cat cracker recycle stock is made at the Eagle Point Refinery of The Texas Company. The furfural unit is pictured here.

Through the years QO furfural has gained widespread recognition as a selective solvent in the processing of lube oil, and now there is a growing awareness of its desirable characteristics as a solvent in performing other separations in the refinery. Better furnace oils, improved diesel fuel, and a new approach to increasing gasoline output of catalytic crackers at minimum expense are the direct results.

The same combination of basic properties and attractive economics which have made QO furfural so successful in refining lube oil applies with equal force to these newer applications. These basic values include: sharp selectivity, ease of recovery, low cost, ready availability, and freedom from excessive toxicity.

The furfural processes are available for licensing and we are glad to refer you to the licensor, as well as to supply additional information about QO furfural itself. Write for bulletin 203.

QO CHEMICALS

The Quaker Oats Company CHEMICALS DEPT.

340E The Merchandise Mart, Chicago 54, Illinois
Room 540E, 120 Wall St., New York 5, N. Y.
Room 440E, P. O. Box 4376, Portland 8, Oregon

In the United Kingdom: Imperial Chemical Industries Ltd., Billingham, England
In Europe: Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France
In Australia: Swift & Company, Pty., Ltd., Sydney • **In Japan:** F. Kanematsu & Company Ltd., Tokyo

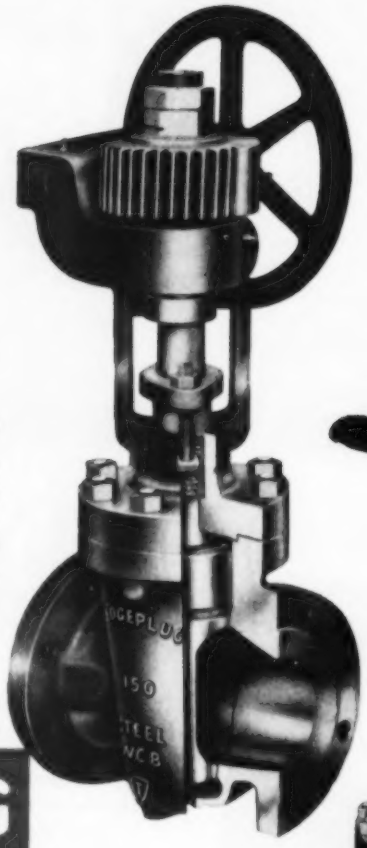
For more data on advertised products, use Readers' Service Cards, last page.

DEPENDABLE

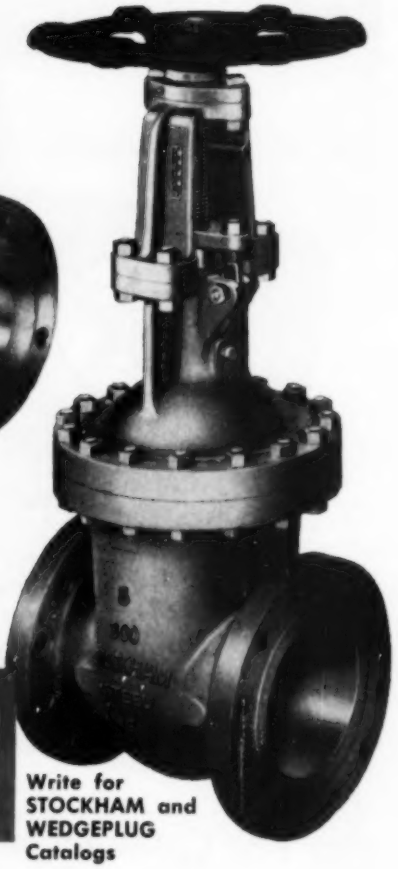
•at HIGH TEMPERATURE

•at LOW TEMPERATURE

WEDGEPLUG Steel Dry Plug Valves that need no lubricant and STOCKHAM Cast Steel Gate Valves both meet the exacting requirements of the Petroleum, Petro-Chemical, and Chemical Industries. For more than a half-century, the Stockham Organization has been recognized for the dependability of its products.



"KNOW HOW" ASSURES THEIR GOOD PERFORMANCE



WEDGEPLUG
STEEL DRY PLUG VALVES

STOCKHAM
CAST STEEL GATE VALVES

Write for STOCKHAM and WEDGEPLUG Catalogs

WEDGEPLUG VALVE COMPANY, INC.
NEW ORLEANS 25, LA.
An Affiliate of
STOCKHAM VALVES & FITTINGS
GENERAL OFFICES AND PLANT, BIRMINGHAM 2, ALA.

STEEL DRY PLUG VALVES • CAST STEEL GATE VALVES
BRONZE VALVES • IRON BODY VALVES • PIPE FITTINGS
Distributed Through Wholesalers
WAREHOUSE STOCKS CONVENIENTLY LOCATED

CONOCO

New installations recently placed in operation at Lake Charles, include units for crude oil distillation, catalytic cracker feed preparation, Thermofor catalytic cracking, gas recovery, catalytic polymerization, catalytic reformer feed preparation and aromatics extraction.

GREATER CAPACITY– EFFICIENCY– ECONOMY FOR CONOCO

For Continental Oil Company, Stone & Webster Engineering Corporation designed and constructed seven types of process units and enlarged an existing alkylation unit at the Company's Lake Charles, Louisiana, refinery.

Continuous flow through several of the units minimizes the need for intermediate offsite storage facilities; and all units are closely integrated for high heat economy.

These new units more than tripled the capacity of the refinery.

Write or call us for detailed information as to how our engineering, design, construction, report and appraisal services may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

BADGER PROCESS DIVISION

AFFILIATED WITH E. B. BADGER & SONS LIMITED (LONDON)

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Toronto

No maintenance problems with this instrument!

In spite of all of the development work being done on automatic control instruments, the Bristol Series 500 Air-Operated Controller is still the most dependable and trouble-free — as proved by thousands of installations. And here's why:

It's the simplest to service. Only one adjustment with a ¼ in. wrench calibrates the control system. No other adjustment is needed. Control system can be completely disassembled and, after reassembly (even with replacement parts), can be *exactly calibrated by this one simple adjustment.*

It's completely reliable. One user states, "I'm amazed at the way this instrument performs day-in and day-out with little or no attention. We call it the workhorse controller in our plant. And our plant men like to use it, because it gives them the precision results they need without having to fuss with it".

Its settings are exactly reproducible. Reset rate, derivative time, and proportional band adjustments are accurately calibrated and exactly reproducible. You can instantly reproduce established settings without cut and try.

It uses the world-famous Bristol measuring elements. The measuring systems used in Bristol Series 500 Air-Operated Controllers for TEMPERATURE, PRESSURE, FLOW, VACUUM, DRAFT, ABSOLUTE PRESSURE, LIQUID LEVEL, pH, AND HUMIDITY are the result of 65 years of experience in instrument making and application in practically every industry. Bristol measuring elements are recognized the world over for their accuracy, simplicity, and reliability. There just aren't any better measuring elements made than Bristol's.

For more facts and figures about the Series 500 Air-Operated Controllers, write for free 32-page bulletin A120. The Bristol Company, 111 Bristol Road, Waterbury, Connecticut.

4.27

TRADE MARK
BRISTOL'S

BRISTOL

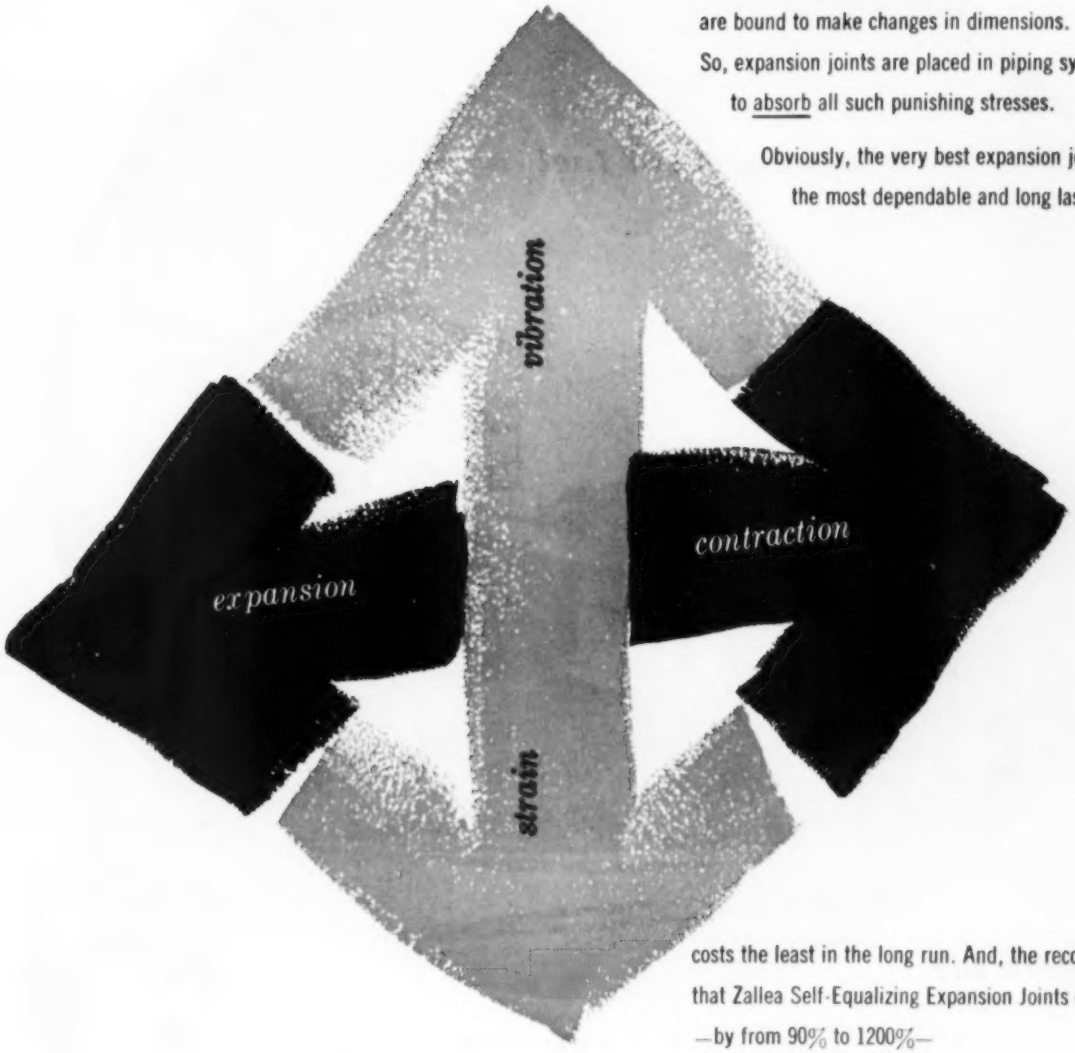
POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

For more data on advertised products, use Readers' Service Cards, last page.

Piping in power, petroleum and processing plants
is designed to move.
After all, service variations
are bound to make changes in dimensions.
So, expansion joints are placed in piping systems . . .
to absorb all such punishing stresses.

Obviously, the very best expansion joint,
the most dependable and long lasting,



costs the least in the long run. And, the records show
that Zallea Self-Equalizing Expansion Joints outlast
—by from 90% to 1200%—
any other self-equalizing
or other type of packless joint.

So, that's why you should insist
that the Zallea name be on
the next expansion joints you buy. To do so protects
both your piping . . . and your pocket book.

Zallea already has, or will make, expansion joints for every service. For information on standard types, ask for Bulletin 351. For consultation on special problems, ask to have a representative call.

Zallea *expansion joints*

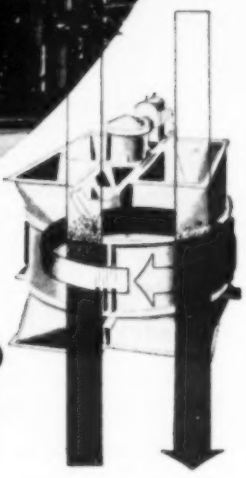
ZALLEA BROTHERS, 890 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints

For more data on advertised products, use Readers' Service Cards, last page.

with the

Ljungstrom Air Preheater



The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

In every processing vessel that burns fuel, air preheat shows the way to save as much as *one barrel out of every five.* When refineries alone burn over 200,000,000 barrels every year, this means the *Ljungstrom Air Preheater* can recover tens of millions of *production dollars* that are now going up the stack.

The Ljungstrom removes precious BTU's from exit gases and transfers them to combustion air. Its effectiveness can be gauged from the fact that every 35-40°F of preheat means roughly a 1% saving in fuel—and Ljungstroms now in use preheat air to over 600°F.

In addition to saving as much as 20% of your fuel, more effective fuel utilization means that your equipment can deliver greater throughput . . . can burn lower grade fuels with less slagging . . . lets you eliminate convection surfaces without reducing production.

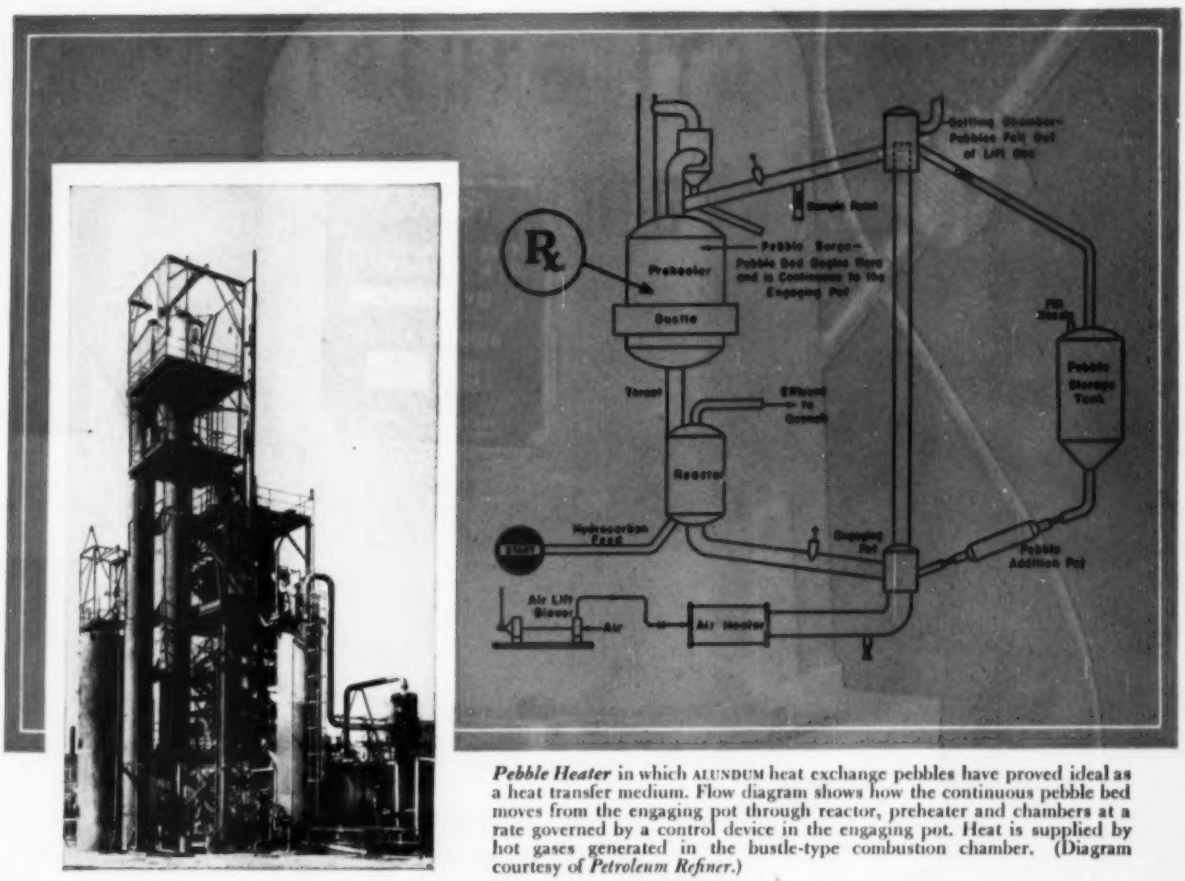
In these days of high fuel costs, every process industry should consider the Ljungstrom for new installations or modernization of existing equipment. Call or write The Air Preheater Corporation for full details.

Wherever You Burn Fuel, You Need Ljungstrom

THE AIR PREHEATER CORPORATION 60 East 42nd Street, New York 17, N. Y.

Rx for cost-saving efficiency

in high temperature processing...



Pebble Heater in which ALUNDUM heat exchange pebbles have proved ideal as a heat transfer medium. Flow diagram shows how the continuous pebble bed moves from the engaging pot through reactor, preheater and chambers at a rate governed by a control device in the engaging pot. Heat is supplied by hot gases generated in the bustle-type combustion chamber. (Diagram courtesy of *Petroleum Refiner.*)

Pebble heaters with ALUNDUM* pebbles

Pebble heaters are now available which are capable of heating gases above operating temperatures permissible in conventional tube furnaces. Low initial cost, high operating efficiency and the use of low cost gas or oil fuel are attracting favorable attention to these heaters for high temperature processing.

For the production of ethylene, for example, the Phillips Petroleum Company has installed a 30 Mm Btu per hour commercial pebble heater at Borger, Texas, following several years of successful pilot plant operation.

In this installation, Norton ALUNDUM heat exchange pebbles have given excellent results. ALUNDUM pebbles, *engineered* to stand up under abrasion, impact and repeated heating and cooling, are *prescribed* as the ideal heat transfer medium for pebble heaters. Also, their high refractoriness, which prevents softening or incipient fusion at any point in the pebble heater's upper bed, keeps them from "bridging" together and causing stoppages in the moving bed.

Rx's for YOUR refractory needs

are included in the broad Norton line of *engineered and prescribed* refractories. For information concerning ALUNDUM heat exchange pebbles or other Norton refractories, or for expert technical aid, call in your Norton Refractories Engineer. Or write to NORTON COMPANY, Refractories Division, 469 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Canada.

NORTON

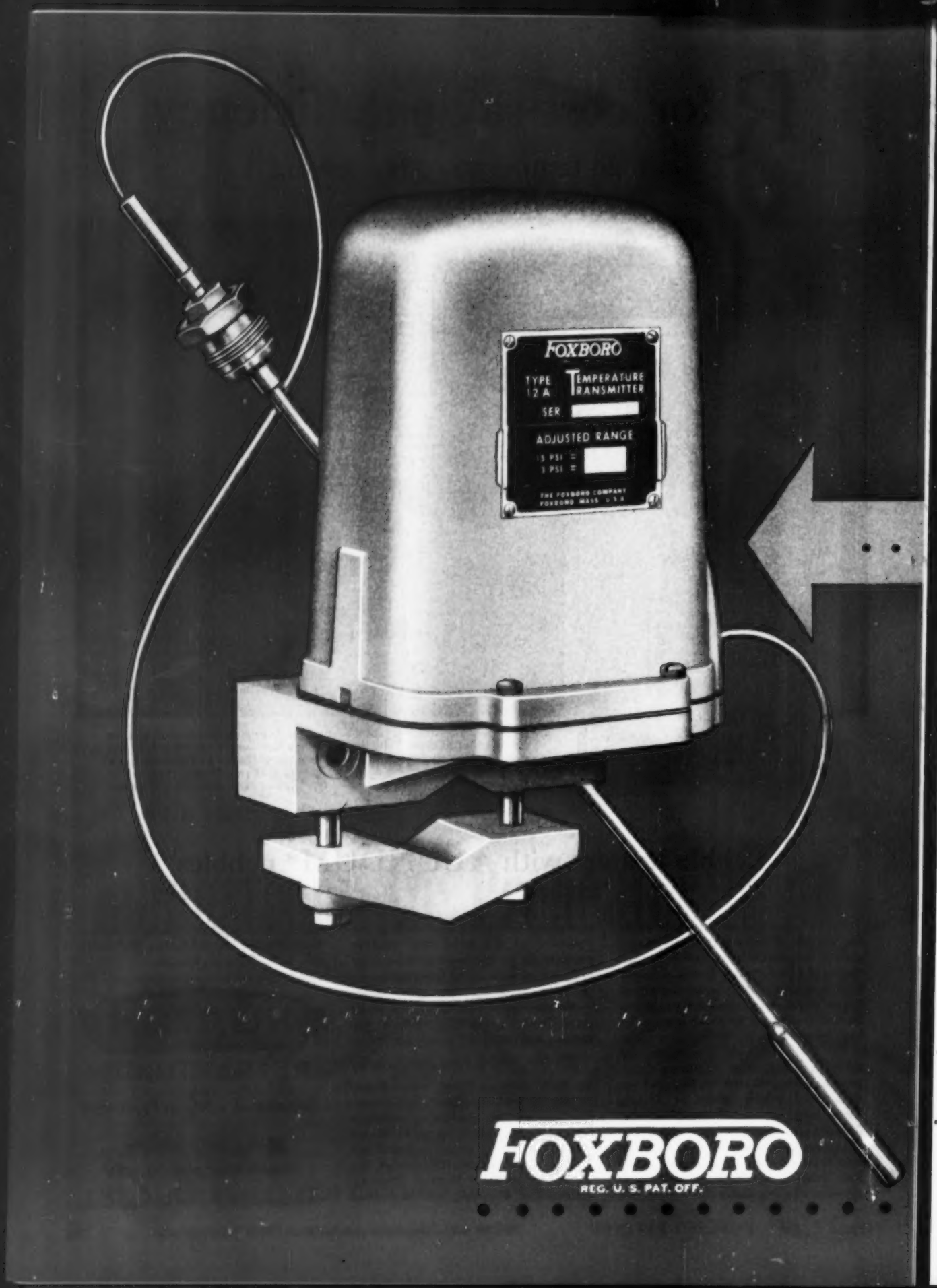
REFRACTORIES

Engineered... Rx... Prescribed

Making better products... to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

For more data on advertised products, use Readers' Service Cards, last page.


FOXBORO
TYPE 12 A TEMPERATURE TRANSMITTER
SER
ADJUSTED RANGE
15 PSI =
3 PSI =
THE FOXBORO COMPANY
FOXBORO MASS U.S.A.
FOXBORO
REG. U. S. PAT. OFF.

Rugged, Versatile Temperature Transmitter Improves Remote Control

. the Foxboro M/12A (pneumatic)

There is no easier, simpler way to measure remote temperatures, *fast*, over so wide a range, with such high sustained accuracy, and at so low a cost!

Between the limits of —100°F. and +1000°F., with operational spans of 50°, 100°, 200°, and 400°F, this rugged, highly responsive instrument performs outstandingly under the most severe conditions. It is fully compensated for ambient temperatures and pressure, and is insensitive to mechanical vibration.

Derivative action can be furnished for optimum performance when substantial thermal or transmission lags exist.

With its weatherproof housing and integral mounting bracket, it can be installed in any hazardous, corrosive, or outdoor location. Transmission lines are ¼" O.D. tubing — no troublesome conduit, no costly capillary to run.

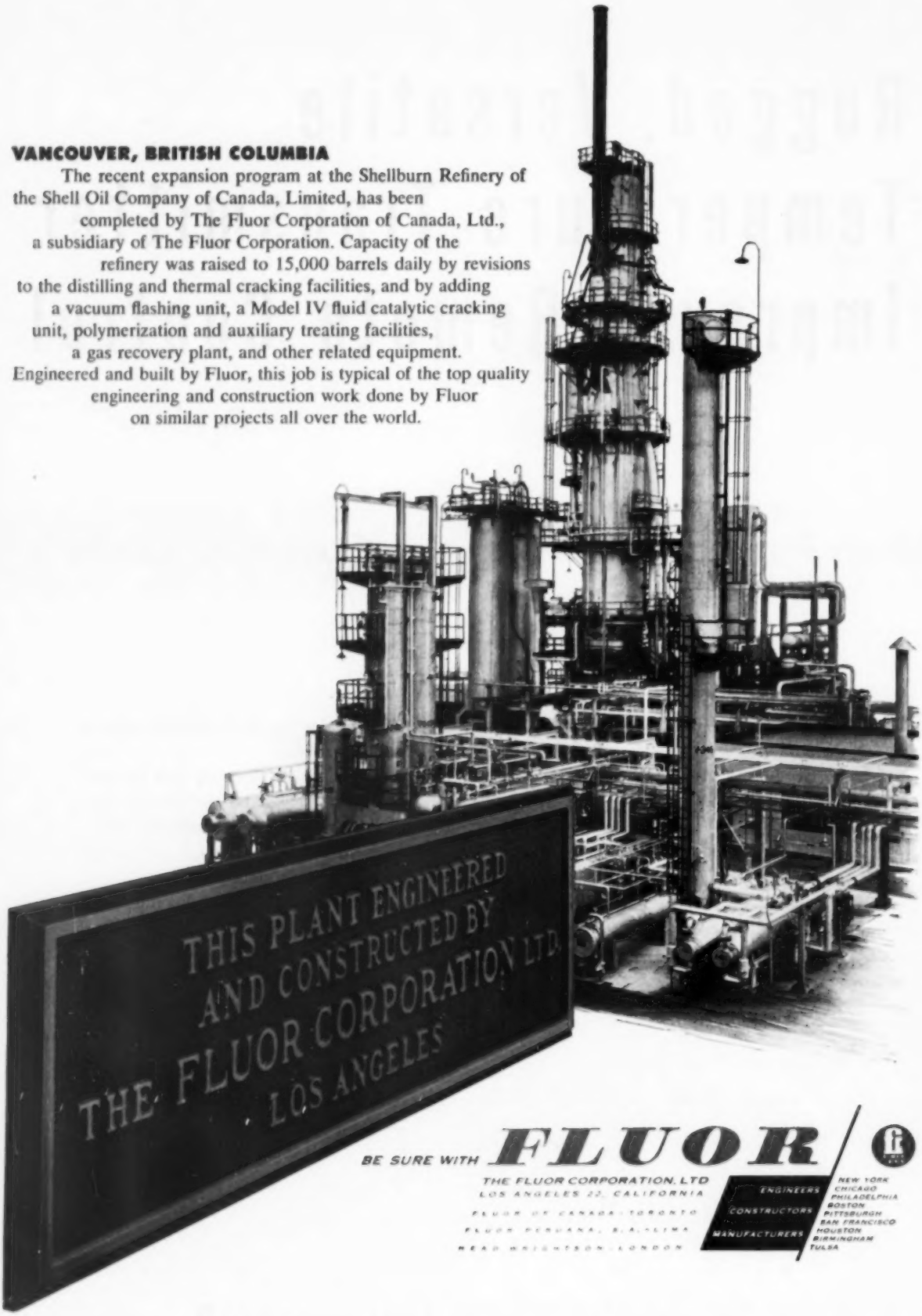
Write for Bulletin 13-17. It explains fully why the Foxboro M/12A Temperature Transmitter gives better performance with lower installation and maintenance cost. **The Foxboro Company, 7410 Neponset Ave., Foxboro, Mass., U.S.A.**

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND

• Pneumatic Temperature Transmission

VANCOUVER, BRITISH COLUMBIA

The recent expansion program at the Shellburn Refinery of the Shell Oil Company of Canada, Limited, has been completed by The Fluor Corporation of Canada, Ltd., a subsidiary of The Fluor Corporation. Capacity of the refinery was raised to 15,000 barrels daily by revisions to the distilling and thermal cracking facilities, and by adding a vacuum flashing unit, a Model IV fluid catalytic cracking unit, polymerization and auxiliary treating facilities, a gas recovery plant, and other related equipment. Engineered and built by Fluor, this job is typical of the top quality engineering and construction work done by Fluor on similar projects all over the world.



BE SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD
LOS ANGELES 22, CALIFORNIA

FLUOR OF CANADA: TORONTO
FLUOR PERUANA, S.A.: LIMA
HEAD WRIGHTSON: LONDON

ENGINEERS
CONSTRUCTORS
MANUFACTURERS

NEW YORK
CHICAGO
PHILADELPHIA
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA

For more data on advertised products, use Readers' Service Cards, last page.

Now

SINGLE SEAT VALVES FOR *Large Flow Rates* WITH ANNIN'S

BUNYAN SERIES

DOMOTOR VALVES

Body Sizes... 6"- 8"- 10"

Body Design... Globe, angle and 3-way. Tight shut-off, single-seat body. Standard, Cooling Fin or Doolseal bonnet.

Body Ratings... Standard ASA 300, 600, 900, 1500, and 2500 PSI.

Operators... Domotor, cylinder and handwheel. Domotor operators for all pressures and pressure drops. Piston sizes of 200 and 400 sq. in. for thrusts up to 40,000 lbs. Domotor or Cylinder strokes to 6" as required.

You'll profit by learning more about the superior features and better performance of Annin Control Valves.

THE ANNIN COMPANY

Dept. PR, 6570 East Telegraph Road, Los Angeles 22, Calif.

ANNIN *Control* **VALVES**

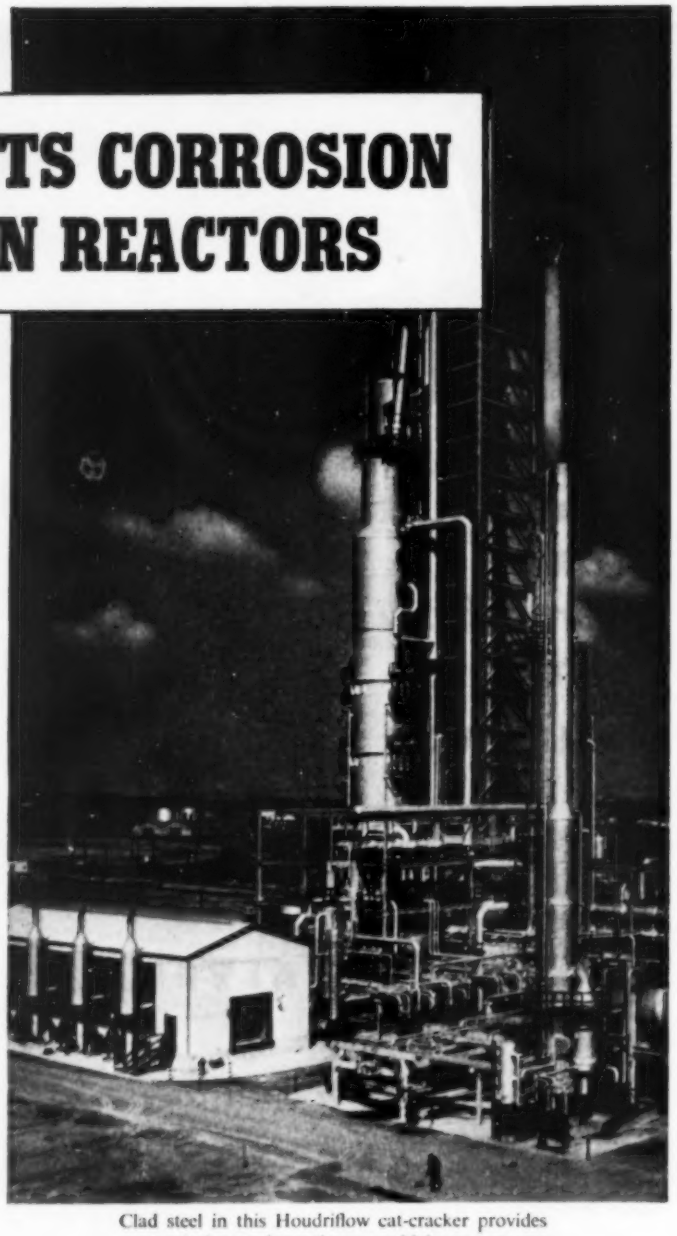
For more data on advertised products, use Readers' Service Cards, last page.

CLAD STEEL CUTS CORROSION IN NEW TWIN REACTORS

This 25,000-barrel-per-day Houdriflow cat-cracker features twin reactor-kilns built into one large vessel for the first time. But designing this unit presented many problems. The reactor, for instance, had to resist corrosive action of the crude fraction at temperatures in the neighborhood of 950°F. To get *economical* corrosion resistance, stainless-clad steel was specified for the cone, shell and an internal head.

To get economical performance like this in other major units of this refinery, stainless-clad steel was specified for the atmospheric, vacuum and synthetic crude towers and for the flash fractionator to minimize corrosion, downtime and equipment failure. The light layer of cladding, inseparably bonded to the carbon or low-alloy backing steel, gives the performance of expensive solid high-alloy plate at much lower cost. Strength and rigidity are supplied by the backing plate.

Now this refinery is ready to meet increasingly competitive conditions as the result of an expansion program that raised operating efficiency and tripled throughput. While still in the planning stages, the refiner's engineers called on the equipment builder to help translate their ideas into the specialized equipment needed. His particular knowledge of fabricating techniques utilizing clad steel helped put this refinery ahead in output and profit. You, too, will find that it pays to consult your fabricator early in your planning for equipment that is lower in cost, longer lived and requires less maintenance.



Clad steel in this Houdriflow cat-cracker provides economical corrosion resistance at high temperatures

Ask one of your fabricators to show you the new Lukens clad steel movie, "Equip for New Profits." Here—in full color and sound—are factual accounts of how clad steel equipment brings new economies. The story can suggest new ideas to everyone concerned with production efficiency. Or contact Manager, Marketing Service, Lukens Steel Company, 681 Lukens Building, Coatesville, Pa.

LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEELS AVAILABLE ANYWHERE

For more data on advertised products, use Readers' Service Cards, last page.

PROCESS EQUIPMENT NEWS

PUBLISHED BY FABRICATED PRODUCTS DIVISION, THE M. W. KELLOGG COMPANY OCTOBER-NOVEMBER 1954

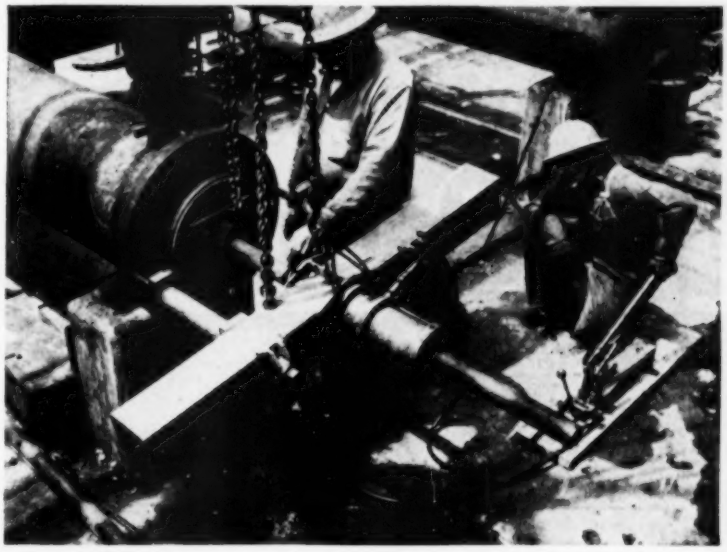
Interchangeable Bundles for Three Condenser Units

Three condensers recently completed in the Kellogg shops for a major refiner represent an optimum interchangeability of bundles—a feature every refiner wants but one that is often difficult to achieve in a unit without over-engineering it.

The three condenser units, designed to handle C-4 cuts, comprise a total of 14 shells. Following normal design practices, initial Kellogg engineering proposals included three sizes of shells. However, further study by Kellogg engineers proved, in this instance, that it would be most economical in the long run to design the entire group of 14 shells for interchangeable bundles. Both proposals were submitted, the customer agreeing that the interchangeable bundle plan best served their purposes.

Each of the 14 sections are of floating tube sheet construction with 2040 square feet of $\frac{3}{4}$-inch admiralty tubes, naval brass tube sheets, and steel baffles. Inside diameter of each shell is 33 inches.

Interchangeable bundles for this many sections will offer several important advantages to the refiner. They will, for example, cut down considerably on refinery maintenance stock, since only one spare bundle need be kept in stock to service any one of the 14 sections. Shorter down-time for repairs are also expected to result from the fact that the spare bundle can be substituted easily in an emergency without shutting the unit down for lengthy repairs or rebuilding.



Portable Bundle Puller Saves Time Eliminates Costly Rigging

Shown here in use at a major Eastern refinery is Kellogg's special device, known as the Hydro-ejector, for removing and inserting heat exchanger bundles.

The device, portable and easily operated by two men, reduces down-time and eliminates the need for "jerry-built" rigging often required to pull even the smallest tube bundles. From the standpoint of time, experience has shown that it takes less than 25 minutes for the device to push a tube bundle out eight feet.

And even the largest bundles will not stick when pushed by the force of 12,000 pounds that may be exerted by the Hydro-ejector. The device is attached directly to the bonnet-end shell flange of the exchanger. It does not pull a bundle; it pushes it.

The Hydro-ejector is safer to use—particularly in the case of overhead exchangers—because workmen do not have to clamber out on the bundle after it is partly pulled to attach hoists. Ropes for lowering the bundle are attached as it is ejected and ride along with the unit from a trolley on the hoisting beam.

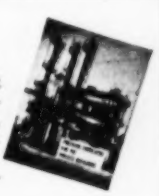
The Hydro-ejector will fit any size exchanger. Although now available for use in existing refineries, the unit was originally designed for customary types of exchangers in new processing plants as a means of reducing investment for supporting steel work. In cases where more than one Hydro-ejector is used, all parts including the jack and pumping unit are interchangeable. The only auxiliary equipment are two hoists, suspended at the channel end of the exchanger, to handle the tube bundle as it is ejected or replaced.

In operation, two men may work it with ease. One is required to pump the jack while the other keeps an eye on the bundle to ensure alignment.

Each unit consists of a hydraulic center-hole jack, supported by a fabricated steel base which is bolted directly to the exchanger. It is self-contained and portable, the heaviest piece of equipment being less than 75 pounds.

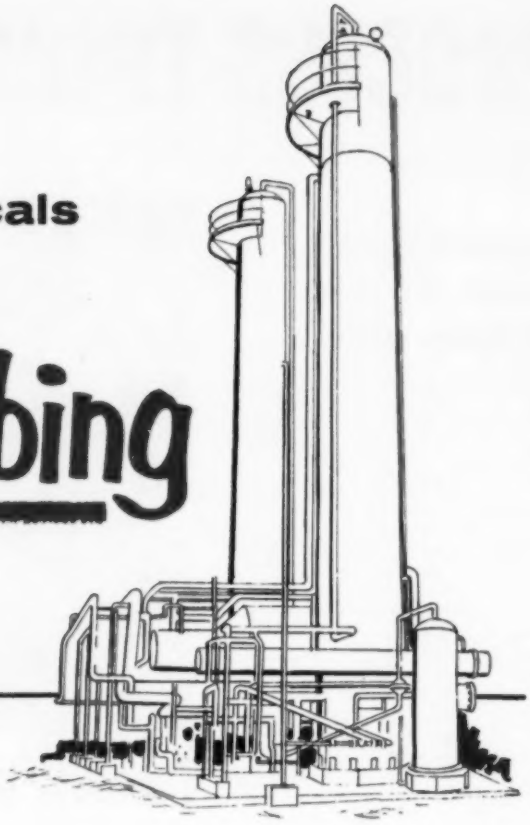
FABRICATED PRODUCTS DIVISION
M. W. KELLOGG
COMPANY
KELLOGG PULLMAN

Send for New Booklet On Kellogg Exchangers



A new booklet which describes in detail the types of tubular heat transfer equipment available from Kellogg has just been completed. It not only shows examples of a variety of heat exchangers, coolers, condensers, reboilers and other process equipment, but also covers in some detail the expanded facilities available at Kellogg since the shops were modified for production-line manufacture of heat transfer units.

3 quality chemicals for superior Gas Scrubbing



Jefferson

monoethanolamine
diethanolamine
diethylene glycol

for sweetening natural and refinery gas

for dehydrating natural gas

Jefferson monoethanolamine, diethanolamine and diethylene glycol are produced at Jefferson's modern plant at Port Neches, Texas, and shipped from conveniently located distribution points at Port Neches, Houston, Chicago and Tenafly, New Jersey.
All three of these highest-quality chemicals are available for immediate delivery—in tank cars, tank wagons or 55 gallon drums. Our technical service staff will be glad to help you with any problems concerning their application. Write or call your nearest Jefferson representative.

Specialists in *essential chemicals from hydrocarbon sources*

Jefferson
CHEMICAL COMPANY, INC.
260 Madison Avenue, New York 16, N. Y.

Branch Sales Offices: Chicago, Houston, Charlotte
West Coast Sales Agent: Nelson A. Howard, Jr., Los Angeles
Plant: Port Neches, Texas
Other Stock Points: Chicago, Houston, Charlotte, and Tenafly, New Jersey

Ethylene Oxide,
Glycols, Dichloride
Ethanolamines
Nonyl Phenol
Morpholine
Ethylene Carbonate
Propylene Carbonate
Polyethylene Glycols
Glycol Ethers

For more data on advertised products, use Readers' Service Cards, last page.

Which of these is your pumping problem?

Name just about any fluid you consider "hard to handle" and we will show you a De Laval pump that will do the job efficiently and at low cost.

De Laval IMO and CPO pumps have solved problems on a wide range of products—hot or cold, acidic or alkaline, viscous or corrosive, clear or filled with suspended solids. IMO and CPO models are available for early delivery.

Your De Laval representative is an experienced application engineer. Consult him on your pumping problems.

DE LAVAL IMO PUMPS
capacities to 750 gpm
pressures to 1500 psig
Write for Bulletin LG-A

DE LAVAL CPO PUMPS
capacities to 2000 gpm
heads to 200 feet
Write for Bulletin 1125-B

DE LAVAL *Pumps*

DE LAVAL STEAM TURBINE COMPANY
811 Nottingham Way, Trenton 2, New Jersey

DL 236A

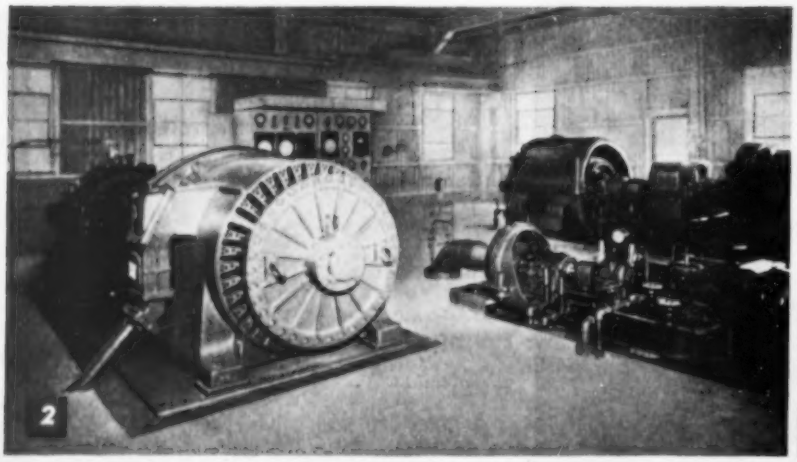
For more data on advertised products, use Readers' Service Cards, last page.

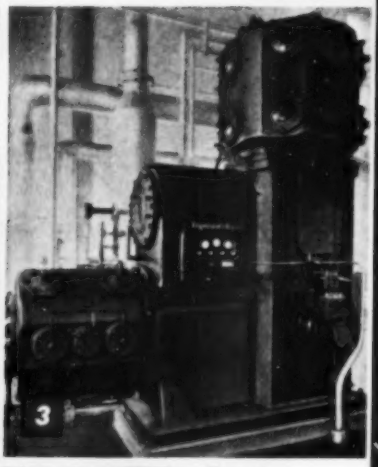
on stream at the

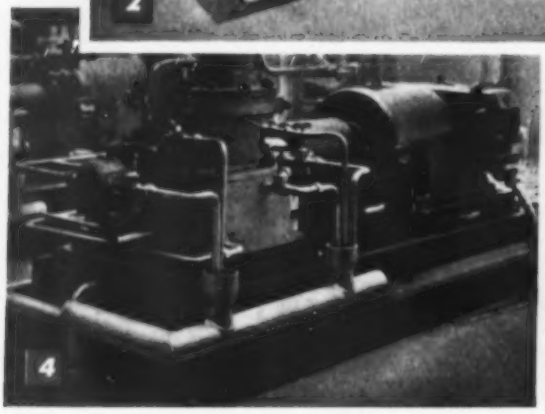
ESSO STANDARD ANTWERP REFINERY

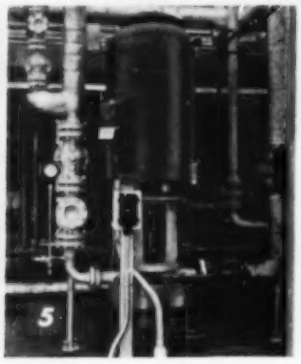
69 I-R PUMPS

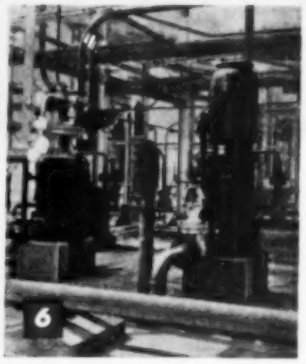
for practically all liquid-moving services



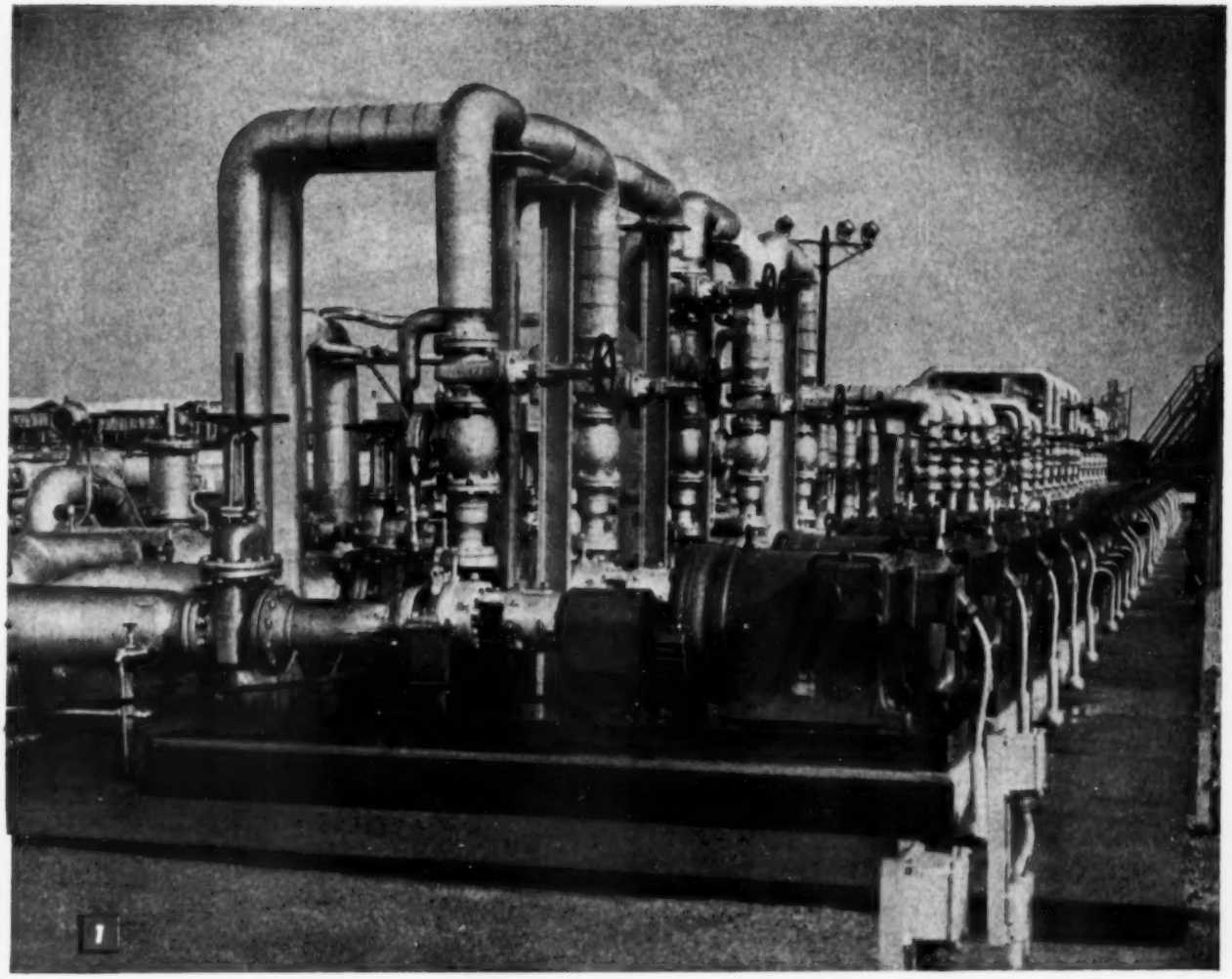








For more data on advertised products, use Readers' Service Cards, last page.



. . . plus I-R Cat Cracking Blowers and Compressors for dependable plant and process air

1. Line-up of 27 Ingersoll-Rand centrifugal process pumps at the loading plant of Esso's Antwerp, Belgium, refinery.
2. Three I-R Turbo-Blowers serving the Model IV cat cracking unit. The two large blowers handle air and gas respectively and the small, single-stage unit in the center provides control air for the regenerating process.
3. Electric motor-driven Ingersoll-Rand Class XLE compressor supplying plant air. A similar compressor is turbine-driven.
4. An I-R two-stage, heavy-duty process pump at Antwerp.
5. An Ingersoll-Rand 20-stage vertical process pump, Class VHTB, handling heavy naptha for the charging furnace.
6. Two I-R vertical process pumps, Class VP, handling kerosene in the SO_2 plant.

HERE AT Belgium's newest petroleum processing plant, *economy* is the keynote. A new, simplified processing technique, perfected by Standard Oil Development Company, has cut overall refinery cost at least 20%. And the resulting savings in operating and upkeep costs make this one of the most economical plants ever built. In production since July 1953, the plant processes 25,000 bbl per day of middle Eastern crude, for gasoline, kerosene, diesel oil and light and heavy fuel oils.

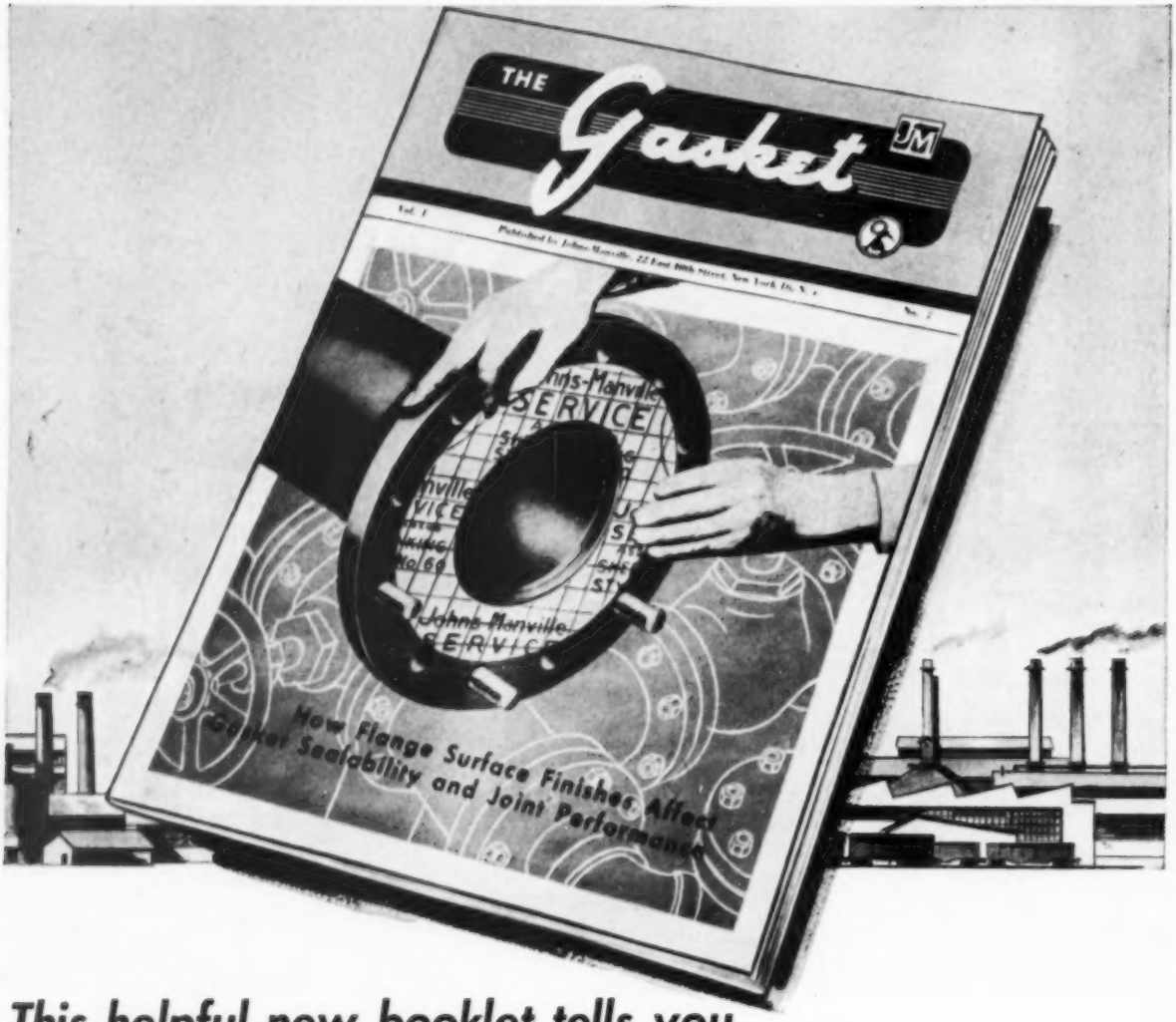
The Ingersoll-Rand equipment shown in the accompanying photographs is another example of the long-range economy of this 225-acre plant. For I-R pumps, blowers and compressors are known the world over for efficient performance and *lasting dependability*. Your I-R representative or branch office will be glad to give you complete information on any of this equipment.

Ingersoll-Rand

11 Broadway, New York, N. Y. 14-74

COMPRESSORS • TURBO-BLOWERS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • VACUUM EQUIPMENT

For more data on advertised products, use Readers' Service Cards, last page.



This helpful new booklet tells you

How flange surfaces affect gasket performance

IF YOU BUY, specify or design joints requiring gaskets, you will find helpful information in this new booklet. It provides a basis for selecting the flange surface finish most suitable for a given gasket. It explains why the right finish makes it easy to form the initial seal and obtain the best joint performance in service.

This booklet is the latest in a series of technical publications issued by Johns-Manville under the collective title "The Gasket." It is based on studies made at the Johns-Manville Research Center, largest laboratory of its kind in the world. It incorporates the long experience of Johns-Manville engineers in the design of gaskets such as asbestos, fibre and composition types, asbestos-metallic and all-metal gaskets.

Booklet offered without charge

To secure your copy of this study, write for "The Gasket," PK-48A No. 7. Address Johns-Manville, Box 60, N. Y. 16; in Canada, 199 Bay St., Toronto 1, Ont.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

For more data on advertised products, use Readers' Service Cards, last page.

for Lp Gas ODORIZATION

Our continuous world-wide survey of odorization makes the latest information *yours for the asking.* Keep in touch with the people who know gas odorization and offer you their experience through their products —

Our Ethyl Mercaptan — the traditional LP Gas Odorant — completely free from both inert materials and heavy ends.

LP CAPTAN — the blended light odorant — primarily Ethyl Mercaptan and a highly stable reinforcing agent — recommended for Butane and Propane systems.

Prompt Service from our . . .

- EXPERT SPECIALLY TRAINED ENGINEERS
- COMPETENT OFFICE FORCE
- STRATEGICALLY LOCATED WAREHOUSES
- RELIABLE SHIPPING SERVICE

DON'T DELAY . . . phone, wire or write us today.

captan

NATURAL GAS ODORIZING CO., INC.

P. O. BOX 1645-A HOUSTON, TEXAS

4949

Badger

Expansion JOINTS

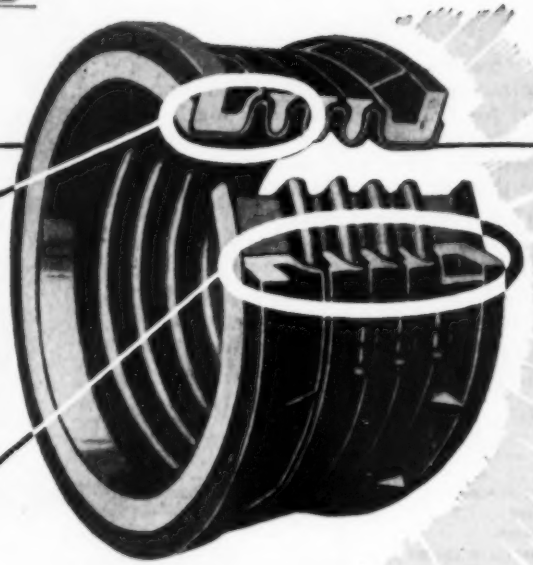
Typifying Joint Engineering at its Best

LONG-LIFE FEATURE

COLD HEATING HOT

the ALL-CURVE, directed flexing, corrugation.*

LONG-LIFE FEATURE



PROPORTIONAL DEPTH of corrugation for each range of diameters and traverse.**

Badger Directed Flexing Self-Equalizing Expansion Joints give exceptionally long service life, proof of which has been well established in the City of New York where more than 4,000 of these Badger Joints are installed in the underground steam lines of the largest district heating company in the world.

*** The exclusive all-curve directed flexing corrugations and matching equalizing rings distribute the flexing stresses over the entire area of all corrugations.**

**** For each range of diameters there is a carefully calculated depth of corrugation with a defined limit of traverse.**

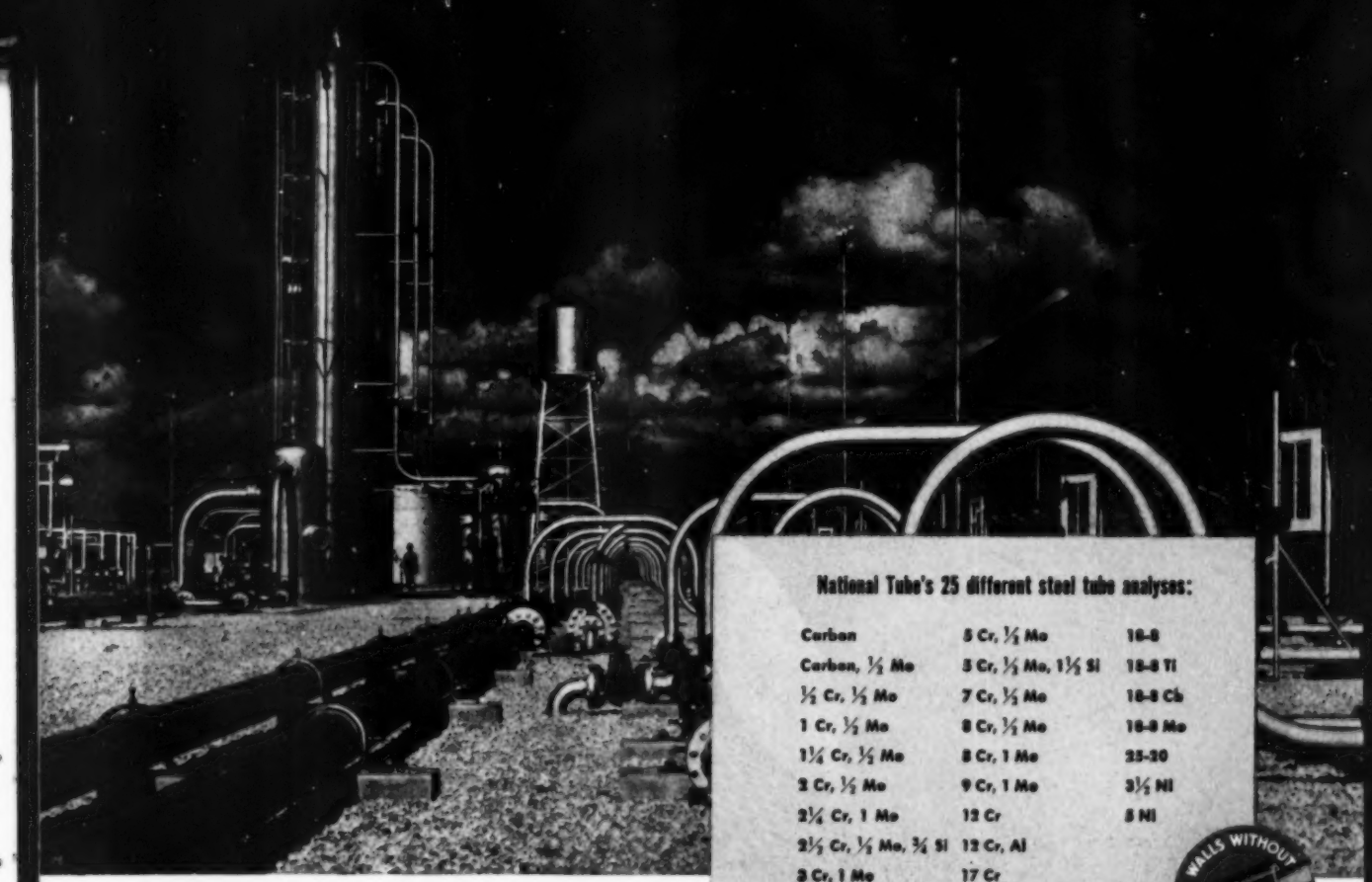
Each Badger Expansion Joint is originally designed with the proper number and depth of corrugations for maximum flexibility and service life at full rated traverse.

Remember — when you want long trouble free service in your distribution system, there is no substitute for the proper number and depth of corrugations. COMPARE BEFORE YOU BUY and to be sure you get the best, specify "BADGER".

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.



National Tube's 25 different steel tube analyses:

Carbon	5 Cr, ½ Mo	18-8
Carbon, ½ Mo	5 Cr, ½ Mo, 1½ Si	18-8 Ti
½ Cr, ½ Mo	7 Cr, ½ Mo	18-8 Cb
1 Cr, ½ Mo	8 Cr, ½ Mo	18-8 Mo
1¼ Cr, ½ Mo	8 Cr, 1 Mo	25-20
2 Cr, ½ Mo	9 Cr, 1 Mo	3½ Ni
2¼ Cr, 1 Mo	12 Cr	5 Ni
2½ Cr, ½ Mo, ¾ Si	12 Cr, Al	
3 Cr, 1 Mo	17 Cr	

25 different answers

to the problems of corrosion, temperature and exposure

NATIONAL Tube has developed 25 different steel tube analyses, each for the specific purpose of overcoming actual conditions of corrosion, oxidation, temperature, pressure and exposure. All of these analyses have been thoroughly tested in refinery service, so that we know exactly what each one should do. Other chemical compositions are also available in tubular products, and a wide variety of high temperature problems are now under study.

If you're having difficulty deciding on what analysis *you* need for a particular application, get in touch with us. We'll make a study of your installation conditions and recommend the best pipe or tubing for the job. Our engineers are specialists in their line and anxious to help you. What's more, they are backed-up by National Tube's "experience file"—a collection of authentic case histories built up over 60 years of working out the most difficult tubing problems for our customers.

No matter what your tubing problem is, we'd like the opportunity to help you. Look over the 25 analyses listed here. Then, before you make a definite decision on new pipe or tubing, consult our engineers—at no obligation. They'll recommend the analysis that will do the most efficient job at the least expense to you. Write to: National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS NATIONAL SEAMLESS PIPE AND TUBES

UNITED STATES STEEL

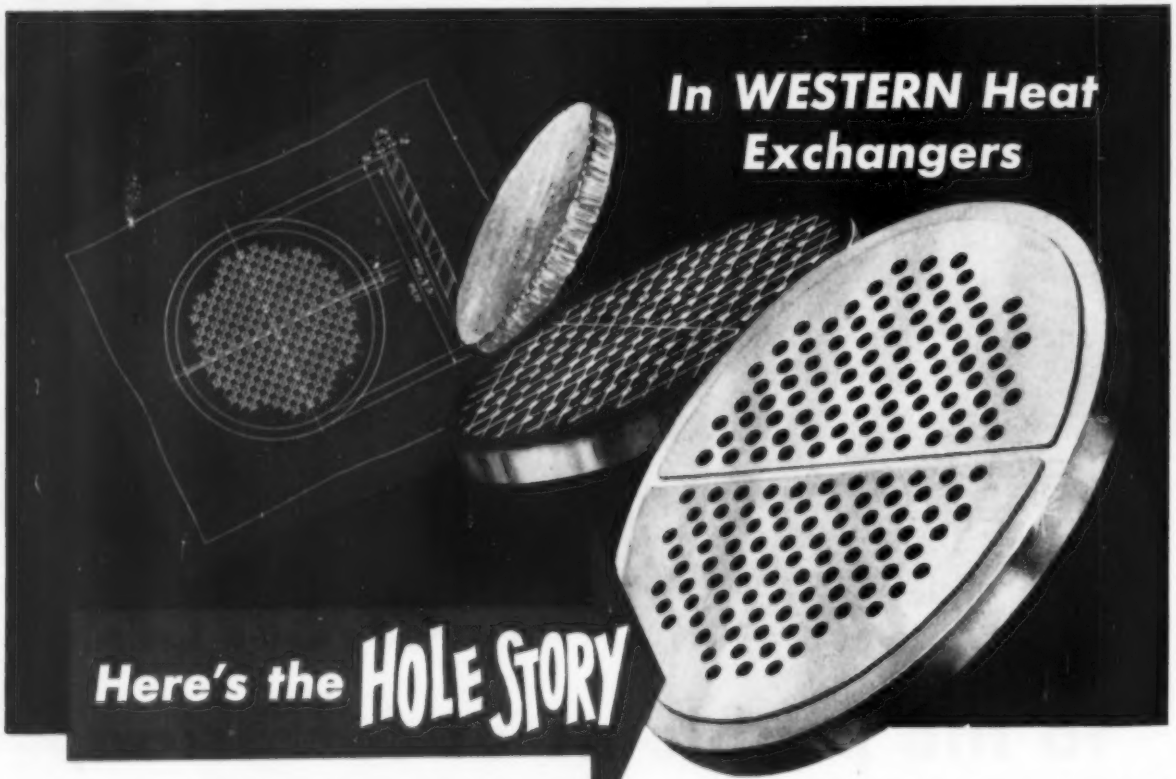
"THE BRAND OF PROGRESS"

By Heat Exchanger Specialists

▲ SYNOPSIS OF AD #6: The many complexities of the modern processing industries have greatly elevated the importance of the metallurgical engineers and welding technicians of Western Supply Company. These men, working as a team, have guided Western through years of delicate fabrication in the AISI Stainless Steels in the 300 series . . . High Chrome Irons . . . the Refiner's Alloys, the low chrome Moly Steels . . . Monel . . . Copper . . . Copper Silicon . . . . . Nickel . . . Aluminum.

When fouling of heat exchanger tubes and shells is a tough problem . . . you can rely on the special metal design and fabrication experience of Western Supply Company.

seventh in a new series of advertisements



Here's the HOLE STORY

Drilling a hole should be a simple operation. Thousands of work-shop hobbyists do it every day. But in the Western Supply Company plant, drilling a simple hole becomes a science.

These holes, in the stationary and floating tube-sheets must hold the heat exchanger tubes in a vapor or fluid-tight joint. Many tube-sheets have hundreds of such tube holes. A leak in any one, by permitting the mixing of shell-side and tube-side fluids, could prove costly, dangerous or both. To prevent this, TEMA (Tubular Exchanger Manufacturers Association) tube-hole tolerance for normal fit is plus/minus .002 of the specified tube hole diameter. In addition to tube hole diameter, the location of holes and accuracy of ligament between holes as well as tube hole drift are equally important factors.

To assure meeting TEMA specifications, Western's drilling technique is as follows:

1. After tube sheet machining, tube holes are scribed by the layout department.
2. Fully scribed, the hole locations are then carefully center punched.
3. With the completely layed-out tube sheet on the drill press, drill position is exactly established with a dead center tool and the radial drill locked into position.
4. The hole is drilled .015 under final specification.
5. The tube hole is reamed to size, normally .010 plus/minus .002 over nominal tube diameter.
6. All tube holes for Class R equipment have two 1/8" wide by 1/64" deep serrations.
7. All tube holes are chamfered 45° on both sides of tube sheet.
8. Tube sheets are chemically cleaned to de-grease prior to assembly.

That's "The Hole Story" behind every tube hole drilled at Western Supply Company for Western Heat Exchangers.

WESTERN
HEAT EXCHANGERS

WESTERN SUPPLY CO.

P. O. BOX 1888 • TULSA, OKLAHOMA

The Mail Box . . .

Back Files for Sale

To the Editor:

I have the following back issues of your magazine which I would like to sell:

Refiner & Natural Gasoline Manufacturer, September, 1940, through June, 1942.

Petroleum REFINER, July, 1942 through December, 1945.

Most of the issues are without the advertising sections.

If you are interested in any of these issues, I would appreciate your advice as to their value and the recommended method of shipping. If you are not interested, but know of some one in the San Francisco Bay area who wishes these magazines, please so advise.

J. Kohl
53 Lenox Road
Berkeley, Calif.

Our files are complete, of course; so we are not needing them, but it may be possible that some other reader will be glad of this opportunity.

It's a Catformer

To The Editor:

We would like to call your attention to an error in your August issue, page 181. Under "Contruction Capsules," Mid-Continent's new 7500-bpd catalytic reforming unit is wrongly represented as a Platformer. This unit is a Catformer built under license of The Atlantic Refining Company. We realize that process names tend to be confusing but it is most important that all licensee units be properly identified.

B. E. Milner,
The Atlantic Refining Company
Philadelphia

Ed's Note—Thanks for the checkup. We are using a corrective item in this issue.

"Excellent Coverage"

To the Editor:

Dear Sir:

While searching for sources of petrochemical information, I came across your excellent coverage in the November, 1953 edition, entitled "Petrochemical Process Handbook."

If it is possible to obtain reprints of this handbook, will you please forward two copies to this office, and bill us accordingly.

E. E. Hackman
The Atlantic Refining Company,
Philadelphia

Fine Style, Always

To the Editor:

Enclosed is one set of the galley proofs on Cycloversion which you submitted for us to check. We have no comments on the write-up other than to express our appreciation for the opportunity to review the article prior to its publication.

We presume this is for the process issue of the REFINER **which you people always do in such fine style.**

A. D. Fischbeck
Perco Division,
Phillips Petroleum Company,
Bartlesville, Okla.

After 14 years' research in the laboratory and scores of industries, Dragert's chemists have developed the magic, ALL-PURPOSE, *easy-to-use* thread compound called "BIG D." Sold on an unconditional MONEY-BACK GUARANTEE, "BIG D" the *only 90%* TRUE METALLIC LEAD thread formula (not lead oxide) — is *revolutionary* in that besides providing a lasting leak-proof seal against the most punishing pressures and hellish temperatures of gas, oil, water and all hydrocarbons, "BIG D" *spins a flawlessly smooth, protective lead-plating,* ISLAND HIGH, *in all types of threads* . . . and this chemically perfect, lubricant-seal of *specially atomized, pure, pig lead, scientifically insures phenomenally increased thread life* . . . pipe-joints, nuts, studs, flanges, anything threaded, CAN'T *gall, burn, freeze, seize,* or *twist-off* . . . ALWAYS PERMIT FREE REMOVAL. Finally, "BIG D" is almost unbelievably economical, affording MAXIMUM *sealing and thread life with* MINIMUM *doping.*

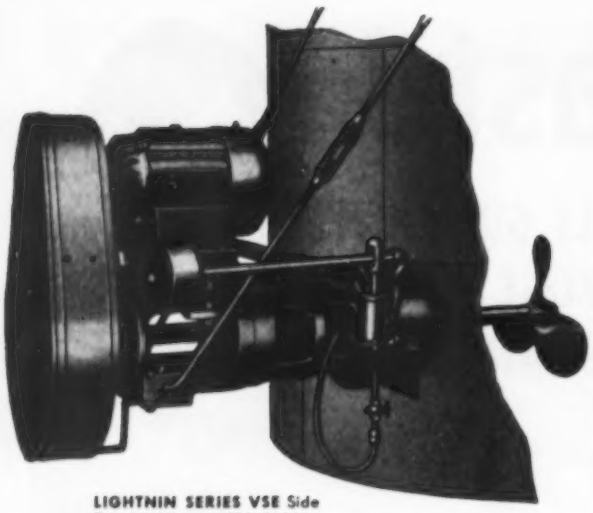
C. H. DRAGERT CO., INC., (23rd Year in Business)
Chalk Hill Road (P. O. Box 5092)
Dallas, Texas

Gentlemen:
Entirely without cost or obligation, please send me a one-pint sample can of Dragert's "BIG D" 90% Metallic Lead ALL-PURPOSE Thread Compound, and descriptive brochure, "The Inside Dope on Dragert's 'BIG D'"

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____ CITY & STATE _____

25,000 LBS. TORQUE-TESTED

For more data on advertised products, use Readers' Service Cards, last page.



LIGHTNIN SERIES VSE Side Entering Mixer . . . V-belt drive.

LIGHTNIN SERIES SE Side Entering Mixer . . . gear drive.

Which mixer is best for *YOUR* big tanks?

The bigger the tank, the more economical it is to choose mixers closely matched to your needs.

You want just enough power to give you rapid, thorough tank turnover—but no wasted HP.

That's why each of the LIGHTNIN Mixers shown above is supplied in *nine* sizes, from 1 to 25 HP.

What's the best shaft seal?

Your operating conditions may call for any of *four* standard LIGHTNIN stuffing boxes, or a full range of rotary mechanical shaft seals. In any case, the type you need is available and has been proved in use.

How about motors?

Years of trouble-free maintenance may depend on your choice of a motor. With LIGHTNIN Mixers, choose from standard horizontal foot-mounted or vertical flange-mounted types, in all enclosures, and a wide range of special motors. All are fully guaranteed.

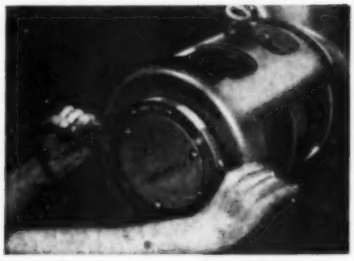
Getting the right materials

If corrosion or chemical attack is a problem, you can have the mixer's wetted parts in Carbon Steel, Types 304 and 316 Stainless, Everdur Bronze, Monel, Nickel, Hastelloy B or C, or any other commercially available alloy or metal, and with rubber, lead or other types of covering.

No risk; here's why

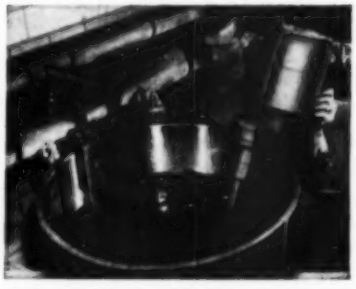
Finally, the LIGHTNIN guarantee protects you two ways: against mechanical failure; against process failure. Every LIGHTNIN is guaranteed to do the job for which it is recommended, or your money back.

If you're thinking about mixing or blending in big tanks, ask your nearby LIGHTNIN man to give you the facts. You can get started *now*, without any obligation, if you call him today.



EASIEST MAINTENANCE EVER . . . with either type, tank shutoff is actuated by turning these easy-to-get-at handles, for repacking or changing rotary mechanical seal with tank full.

FOR PETROCHEMICAL MIXING, hydrogenations, solids suspensions, high-efficiency stripping operations, LIGHTNIN Turbine Mixers offer complete adaptability. Sizes 1 to 500 HP.



FOR CAUSTIC TREATING, feed water treating, preparing specialties, and dozens of other jobs, you can standardize on LIGHTNIN Portable Mixers. Thirty models. Sizes ⅛ to 3 HP.

Lightnin® Mixers

- ☐ DH-50 and DH-51 Laboratory Mixers
- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller type)
- ☐ B-104 Side Entering Mixers
- ☐ B-106 Condensed Catalog (complete line)
- ☐ B-107 Mixing Data Sheet
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The LOOK BOX for October . . .

One Brief for Oil Progress Week

IF DURING Oil Progress Week, October 10-16, it could be arranged so that every motorist in the United States could read the item below, why we'd settle for the accruing benefits, ask for nothing further from the industry's yearly educational effort. The item:

PITY THE POOR ROMANIAN MOTORIST

Consider the poor motorist in Romania.

Gasoline costs almost $2.40 a gallon, although the nation has great oil fields.

Price is high because the Russians take most of the oil Romania produces.

Motorists in the United States get a much better break. Private management of oil companies keeps competition keen, prices low and supplies plentiful.

Of course the results would be better if, for a brief period, the American motorist was forced to get his gasoline from a shambly joint such as has been pictured as the typical Russian "filling station" AND pay the price that, for example, the Romanian motorist pays. But we in the industry, who would impress our fellow Americans with the advantages that too often we all take for granted, would not bring that situation about even if we could. It's a shudder just to think of it.

But we would like to have as many Americans as possible read again that brief reproduced above. And give it a bit of thought. They'd be better Americans for it and the oil industry would more nearly approach in their minds the rating and appreciation that it deserves.

Outshouting Karl Marx

WHEN THE RIVER of misunderstanding that divides our troubled world is traced back to its black and bitter source springs, there is found the 100-year-old denunciation of Karl Marx against the accumulation of goods beyond bare subsistence.

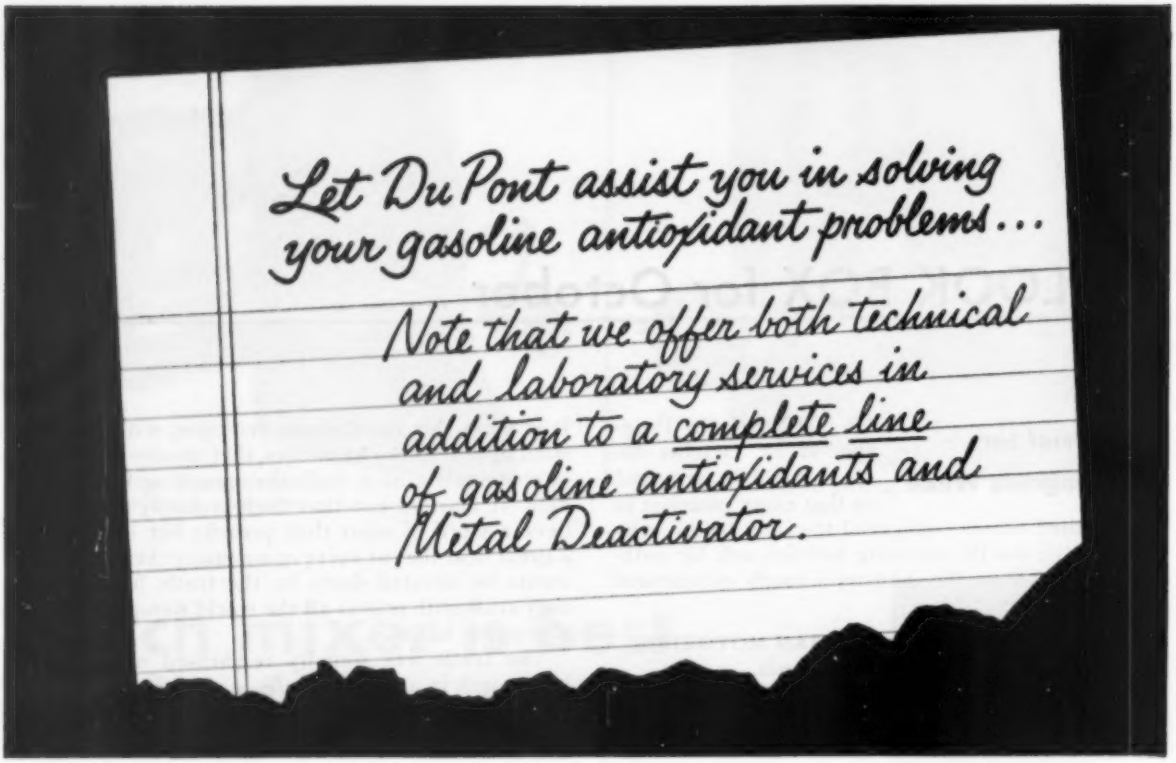
Marx propounded that the concentration of wealth in the hands of a few would hasten the demise of the competitive free-enterprise system. It is upon this mendacious principle, with its tinseled appeal to the have-nots, that the cunning men of communism have built the spreading empire of hate. It matters not that they probably don't believe a word of what they preach; but it matters a great deal that at every opportunity their preachments be shouted down by the truth, lest finally they stuff with poison all the world's empty bellies and empty heads.

The truth was soundly re-phrased once again last month in a new book, *Big Enterprise in a Competitive System*, by A. D. H. Kaplan, an economist who spent seven years studying big business for the Brookings Institution. Kaplan focused upon the 100 largest industrial institutions of the early 1900's and followed their history for the first half of the century. His findings are in sharp dispute with the doctrine that bigness fattens at the expense of others, a cannibalistic giant among pygmies. Kaplan found that to be big definitely does not guarantee prosperity, or even survival, in competition with fresh new ideas and despite the vagaries of a changing economy.

Of the 100 largest corporations in 1909, only 36 were on a similar list for 1948. And among these 36 there were changes. Standard Oil Company (New Jersey), once Standard Oil Company, had moved up to first place from second, and The Texas Company from 87th to sixth. Moreover, five companies among the first ten on the 1948 roster did not appear among the first 100 in 1909, —companies like Standard Oil Company (Indiana), which is fourth; Socony-Vacuum Oil Company, fifth; and E. I. du Pont de Nemours & Company, eighth.

Kaplan's comment, a mild masterpiece of understatement: "Industrial leadership at the big business level is precarious."

One mighty factor in shaping the fate of individual enterprises has been the country's population growth, bringing as it has a heightened demand for the good things being produced and creating competition in the production of those good things. Where, 53 years ago, there were only four industrial companies with assets of more than $200 million, in 1951 there were 15 with assets exceeding $1 billion, and more than twice as many with assets above $500 million. Likewise, the total number of businesses has grown faster than the popu-


Let Du Pont assist you in solving your gasoline antioxidant problems...
Note that we offer both technical and laboratory services in addition to a complete line of gasoline antioxidants and Metal Deactivator.

Naturally you want to solve stability problems with as little delay as possible—and economically and efficiently as well.

In addition to offering all major types of gasoline antioxidants, there are five strategically located Petroleum Chemicals Division regional laboratories available to study your needs. Their recommendations of the additive that will best satisfy your requirements are made on the basis of a technical and economic analysis of the problem at hand.

Antioxidant No. 5—50% N-normal butyl-para-aminophenol; gives excellent results in motor gasolines.

Antioxidant No. 22 — N,N'-di-secondary-butyl para-phenylenediamine; excellent for both motor and aviation gasolines. Not extractable by water or caustic. Helps reduce sweetening costs, too.

Antioxidant No. 29—2,6-di-tertiary butyl-4-methylphenol; is a new Du Pont alkyl phenol antioxidant that gives good results in aviation gasoline. It offers excellent resistance to extraction by water or caustic.

Du Pont Metal Deactivator — An 80% solution of N,N'-disalicylaldehyde-1,2-propanediamine. This additive is effective in preventing the adverse effects resulting from copper contamination in gasoline. Its use improves storage stability and reduces the treating cost of many gasolines by decreasing the antioxidant requirements.

Our sales-service and technical representatives will be glad to work closely with your staff at any time on antioxidant treating problems. Their recommendations can often substantially reduce treating costs. Just address your request to one of the regional offices listed below.

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lation, increasing from 15.4 per 1000 to 17.

The development of new products has also caused ponderous shifts in the economic tide, bringing whole new industries to the crest, pushing back others. In 1909 the iron and steel industry held 30.8 percent of the assets of the 100 largest companies. By 1948 this figure had dropped to 12 percent, while the petroleum industry grew from 8 percent to 29 percent.

Kaplan's conclusions: "Big business . . . makes a contribution to the total economy that cannot be made by smaller-scale enterprises . . . Big business has not merely been kept effectively subject to a competitive system; on the whole it has also made an essential contribution to its scope, vitality and effectiveness."

NPC Suggests Disaster Plan

OIL'S GENIUS for improvisation which has contributed so enormously to the American way of life can be relied upon as a major defense of that way of life against the perdition of the thermonuclear bomb.

Such was the assurance received recently by the Interior Department's Oil and Gas Division in reply to its request that the National Petroleum Council suggest a program to prevent interruption of the flow of oil and gas if the bombs fall.

After reiterating the necessity for a plan not constricted by picayunish details and the further necessity of administering it with "men who are thoroughly familiar with (the industry's) far-flung and varied operations and facilities," NPC offered this six-point program:

- The Secretary of the Interior should immediately name for each of the five PAD districts emergency committees to guide emergency operations of the industry on a decentralized basis.
- The names of these committeemen should be published to acquaint the entire industry with the program.
- Details of the program should be worked out now so they could be put in motion by Presidential proclamation if an attack comes.
- A PAD-type of organization, responsible to the Secretary of the Interior, should be set up for central guidance and planning as soon after attack as possible.
- Industry should be urged to consider further decentralization when adding new refining or storage facilities. The companies should also be asked to consider interconnection of refining facilities and terminals in different areas by product lines whenever feasible. Gas companies should consider expansion of underground storage and interconnection of systems.
- Encouragement should be given to building up reserves of mobile transportation and equipment, particularly tankers, but also tank cars, barges and tank trucks, in view of the extra load which would fall on transportation facilities in an emergency.

NPC's program is so broad and loose as not to ensnarl the extemporaneous decisions of the men who will be demanding lots of elbow room when the time comes to do the job.

Said NPC: "The greatest asset of the industry in . . . such an attack would be its executives who could quickly draft emergency plans for utilizing whatever facilities remained after the bombing, and get them back into operation in minimum time."

Gasoline Stocks Register Decline

THE NATION'S supply of gasoline still remains on the high side although some drop was registered during the past month. On September 17, U. S. gasoline inventories amounted to 151¾ million barrels, 10 million barrels more than the 141⅔ million that were on hand a year before. In mid-August they were 14¾ million barrels over year-ago levels; so in one month the margin of difference was lowered 4¾ million barrels. However, east of California stocks were 12¼ million barrels over last year's total. On the West Coast, motor fuel now totals 2 million barrels less than was in tanks a year ago.

Other products are in good balance with demand.

Distillate fuel inventories on September 17 amounted to 124 million barrels, up 1¾ million from a year ago. Those stocks will begin to decline soon, as the heating season gets under way. With demand expected to be higher this year, distillate supplies could possibly be considered on the low side.

Residual fuel oil stocks appear in good shape. While residual is 5 million barrels above last year's, all of the increase is located in California. Stocks east of California are 3¼ million barrels below the 1953 level, while California's inventories are 8⅓ million barrels higher.

Recommended—

Industry Must Face Up to Its Problems!

See Page 96

KNOW YOUR FABRICATOR BEFORE YOU BUY

One of a series . . . designed to acquaint you with

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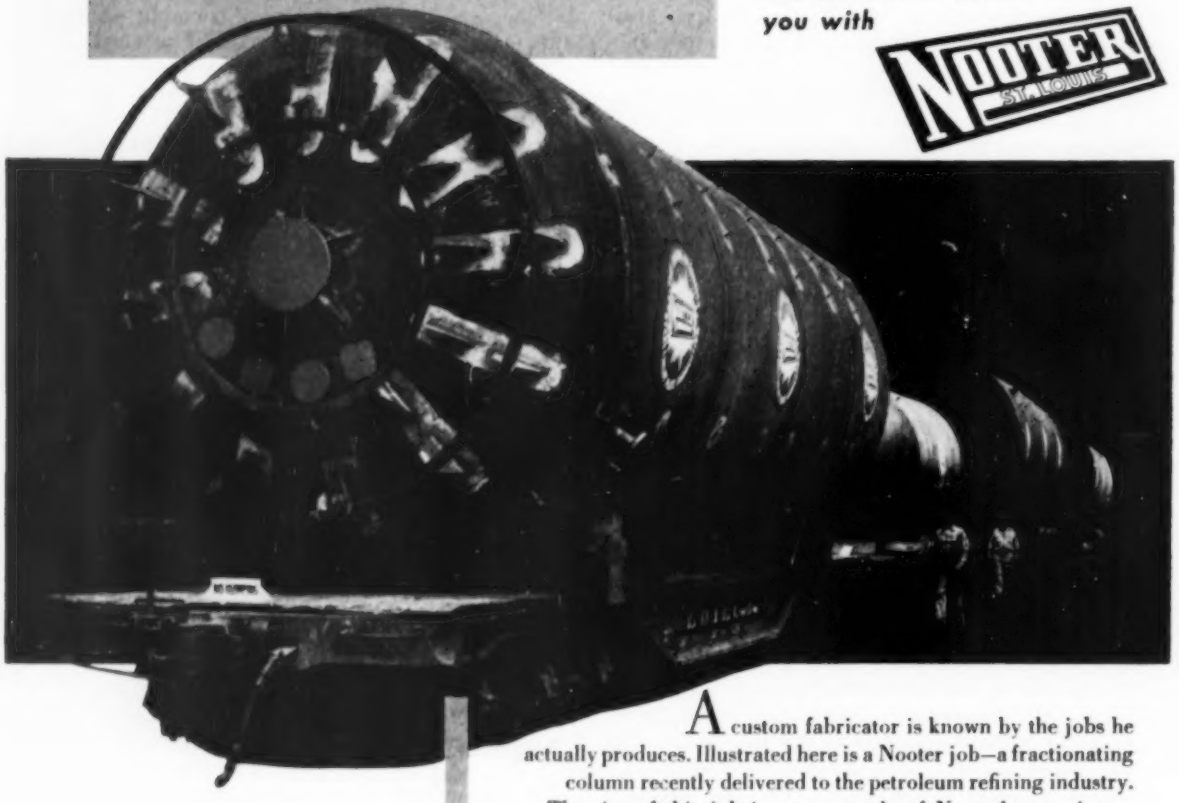

EXAMPLES
speak louder than words

A custom fabricator is known by the jobs he actually produces. Illustrated here is a Nooter job—a fractionating column recently delivered to the petroleum refining industry. The size of this job is one example of Nooter's experience:

- 13 ft. diameter, 155 ft. long, weighing 235 tons.
- All-carbon steel, stress relieved in the Nooter Heat Treating Furnace.
- Six flatcars needed to ship to destination.
- Over 10,000 bubble caps, installed in 55 trays. Assembled trays had to satisfy a tray level tolerance of $\pm 1/8''$.
- Final field assembly, engineered by Nooter Field Construction Dept.
- Completed and delivered on time within 4 months of order.

One of the 55 bubble trays containing over 10,000 bubble caps.

Your custom fabrication of tanks and processing vessels in steel or any alloy, from 12 gauge to 4" plate, will be handled with the same skill, backed by 58 years of experience, with a dependable delivery date and at competitive prices.

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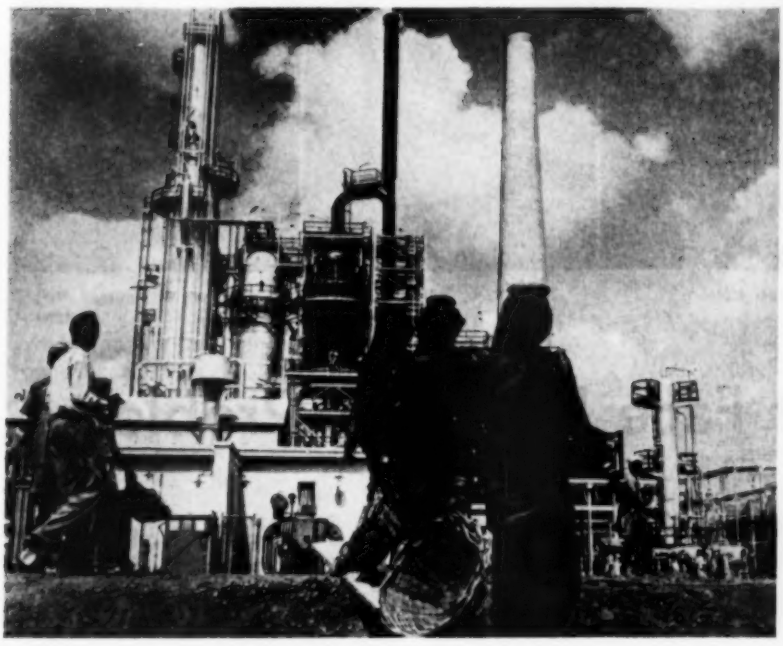
Steel and Alloy Plate Fabricators and Erectors . . . "Boilermakers"

For more data on advertised products, use Readers' Service Cards, last page.

Who's Building . . .

CONSTRUCTION BOXSCORE starts on page 184



INDIAN women return from carrying baskets of earth-fill on their heads for small grading operation near Stanvac's new Bombay refinery unmindful of nearby roaring of modern bulldozers and earth-moving machines.

HEART of the refinery's processing area is this combination unit, with the sulfur dioxide plant in foreground.

A Modernism Comes to India

Stanvac's new Bombay refinery, started up six months early, ends India's weird position of needing oil imports but hurting when she got them.

A NEW 25,000-barrel-a-day refinery at Bombay, representing another leg in India's journey in industrial progress, has been put in operation by Standard-Vacuum Oil Company six months ahead of schedule.

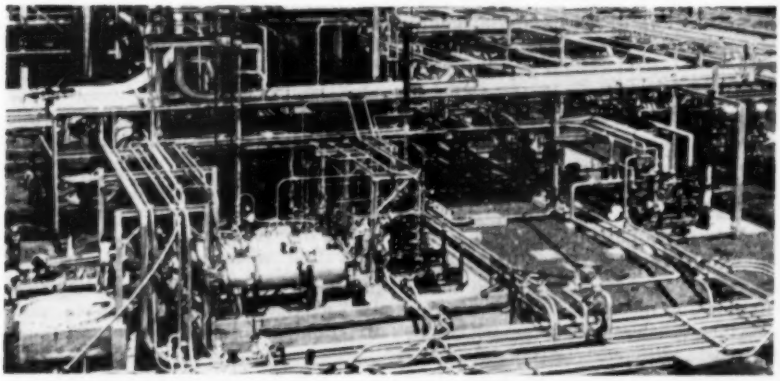
First major multi-product refinery in Asia—and one of the most modern, the new $32 million installation will soon be running at maximum capacity, turning out 8,580,000 barrels of products a year, equivalent to one-third of India's total petroleum needs.

Its Importance. During the postwar years, India's economy was predominantly agricultural, with industrialization infiltrating slowly. Then, in a five-year period beginning in 1948, industrialization speeded up; there was a sharp rise in the consumption of energy and oil came into its own as an energy source. From 1948 to 1952, oil's share in the total energy supplied in the country jumped from 17.3 percent to 23.9 percent. Before the Stanvac refinery, India was almost wholly dependent on imports for this supply, and, as a result, found itself in a paradoxical position. It needed the imports to continue its industrialization process but the more it imported the more its economy suffered. The new refinery thus fills two needs:

See **INDIA'S NEW REFINERY** and

More Construction Items

Page 173



MAZE of piping is only part of intricate hookup needed for combination unit operation.

Bruce K. Brown | Michael Halpern | R. L. Tollett | John W. Newton

Industry Must Face Up to Its Problems

Here is some straight talk from industry leaders. We asked them: What is really the situation as regards capacity and market? How serious is it? Are we solving it?

THE FOG of uncertainty caused by high inventories of some products can be dissipated by the sunshine of courageous planning.

This, generally, reflects the thinking of four executives whose firms typify virtually every important ramification of the refining industry. Petroleum REFINER asked these questions . . .

1. "What is really the situation as regards refining capacity and the market for refined products?"
2. "Is the inventory situation serious, or are the figures misleading?"
3. "What is the outlook for refining capacity?"

. . . of these industry leaders:

- Bruce K. Brown, President, Pan-Am Southern Corporation, New Orleans.
- John W. Newton, Vice President and Manager—Refining, Magnolia Petroleum Company, Beaumont.
- R. L. Tollett, President, Cosden Petroleum Corporation, Big Spring, Texas.
- Michael Halpern, Senior Vice President, The Texas Company, New York.

The executives agreed one and all that the industry's present difficulty is nothing more than one of those occasional rocky stretches to be found in the sometimes devious highway of free enterprise.

"This type of maladjustment," said Brown, "has occurred before and will happen again."

But what of cause and cure? Here there was a lessening of harmony. The executives' views on these vital questions are as follows:

JOHN W. NEWTON, Vice President and Manager-Refining, Magnolia Petroleum Company, Beaumont, Texas.

THE MOST DIFFICULT question now confronting the refining industry is the one arising because of motor gasoline over-production, a substantial part of which is the "regular" grade. Fortunately, some of this material could be used to meet expanded jet fuel requirements of the military and thereby to help keep the surplus from being even more than it is.

In my opinion, the present excess represents a serious imbalance and indicates rather strikingly that recent completions of additional refining units have had an important bearing on the build-up. Today's high gasoline inventories apparently provide much support for the view of quite a number that accelerated tax amortization, with its inducement to expand facilities, proved to be so attractive that the validity of the law of supply and demand was temporarily obscured. Assuredly, the rule has received less consideration during recent months than sound economics would suggest.

However, that is not the whole story. Another significant part is that refiners felt their responsibility—and rightly so—to be ready to supply in 1954 an appreciably increased gasoline demand. The industry entered the current year with an anticipated requirement over 1953 estimated at from 4 percent to 5 percent. By way of contrast, published data on actual consumption for the first seven months show only about 2 percent more required, or less than one-half of what had been initially forecast.

To the extent that reported inventories include working stocks, tank bottoms and line fills in newly-built tanks and products pipe lines, then to that extent—and it is not a sizable item—the figures overstate the surplus. As the demand for products grows, facilities for handling them must be enlarged proportionately and inventories increased enough to provide for operation of the equipment installed.

To the argument offered from time to time that the drive to make more aviation gasoline may have contributed

See REFINING PROBLEMS page 248

Three Ways to Shed the Detail Problem

• Delegate • Select • Streamline

Auren Uris,
Research Institute of America, Inc.,
New York

Dear Boss:
Am up to my neck in detail. Can't keep our appointment.
JOE

Dear Joe:
Stop doing your subordinates' work. Expect you as planned.
R. V.

YOU MAY take a more kindly, less arbitrary view of the problem of detail than did top executive R. V. As a matter of fact, not all routine can be turned over to subordinates. There's no question that a certain amount of detail is an unavoidable part of every executive's workload.

Details Can Be Deadly—

Yet, if you can't lick the problem of detail, it will most certainly lick you. Whether you stay on top of your job, or vice versa, depends largely on your handling of this problem.

Detail can be deadly because it sneaks up on you. A short time may be all it takes to see the change. One day, everything is under control. A week later, you're going down for the third time in an ocean of paper work, routine followup, and so on.

Every executive is familiar with the quick-breeding aspect of detail. Details cluster around the average executive desk like iron filings around a magnet. And it's human nature to try to overcome the difficulty by wading in with phone and pen flying. For this reason, the chances are good that as of this moment, a considerable amount of routine could be removed from your shoulders. Not only would there be no loss as a result, but the increased time you could allot to more important matters would undoubtedly show up in better carrying out of your primary responsibilities.

Your Triple Defense Against Detail—

Every executive has available to him three means by which he can lighten the burden of routine. These should be applied in the following sequence:

... I. Delegate
... II. Select
... III. Streamline

I. Delegate

Delegation is an important executive technique. Putting it even more strongly: the executive who *fails* to use delegation is probably executing not his job, but himself.

As a farmer, wading through a patch of Canadian thistle said, "It ain't all hay." Neither is delegation.

Delegation can cause trouble if the *wrong* duties are handed over:

• Over-all control. No matter how extensive are the delegations you undertake, responsibility for final performance must rest on your shoulders.

• Responsibility for operating policies. You may call upon others to contribute, but you cannot expect anyone else to take the consequences in case of kickback.

• The hot potato. Don't make the mistake of passing one down the line just to take yourself off the spot.

On the other hand, the matters you *can* delegate are fairly recognizable.

Check up on the time you spend now—

... filling out routine reports, requisitions, etc., that could be handled by a clerk, secretary or other subordinate;

... making calculations and entries that a clerk or other subordinate is fully capable of doing;

... making routine checks—on inventory, for example—or other static situations which are basically a matter of ascertaining easily identifiable facts;

... running your own errands—which might be better turned over to a messenger boy or other subordinate;

... engaging repeatedly in certain simple mechanical tasks.

If you can reduce any of these to a matter of a final okay, a signature, or the dispatch of a messenger, they are probably suitable subjects for delegation.

More on Drawing the Line—

At some point, however, you may have to go easy on delegation. It's best to hang on to a chore, for example, if—

• It's too technical. Computing a cost or calculating production capacity may be simple for you, but completely beyond the capacities of a subordinate.

• The duties involve a trust or confidence. In some instances, for example, personnel files or records, cost data, or other highly confidential matter may be involved.

You may find that under certain circumstances it is possible to delegate duties involving initiative, judgment and decision. You may be on firm ground, but you have to consider these factors carefully:

The nature of the duty to be delegated;

The ability of the person whom you are considering to take over the job;

Your ability to keep control—that is, to keep posted on how well he carries out the job, and how quickly you can come to his rescue if he gets into trouble.

The time element is often an im-

portant factor. It sometimes helps to determine whether you can or can't delegate. Problems that don't have to be solved by a given deadline are worthwhile subjects for delegation. The top executive who's having a tough job with a customer may turn over that specific customer-relations problem to a subordinate for consideration and suggested solutions.

You can save yourself the wear and tear of detail work by using the delegation device if—

. . . you make a point of knowing just what your subordinates' abilities are;

. . . you make full use of the collective abilities of the people in your department; (Sometimes no single individual may be able to take over, but a two-man team might provide a perfect solution.)

. . . you avoid taking up new problems or undertaking new procedures yourself without first asking: "Is this something that could be better done by one of my staff?"

II. Select

An office manager recently passed the word along to the head of his automatic addressing machine department: "Check your #3 machine for a broken selector pin."

The supervisor did as directed. To his astonishment, he found that the pin on that machine actually was snapped off short.

There was no witchcraft involved. A sound executive procedure made it possible for the manager to put his finger on the trouble spot.

Frederick A. Taylor, father of scientific management, referred to the method as the "Exception Principle." It's a method of control by checking the *deviations*, the *exceptional* cases.

The bit of magic performed by the office manager had a logical explanation. He had received complaints through his customer relations department about non-delivery of addressed material. All the complaints had come from one area. Since he knew the machine that handled the addressing operation for that area, he reasoned it was that machine that was at fault. A broken selector pin seemed the most likely explanation.

Basically, the Exception Principle boils down to, "Check when things go wrong." But to get the best results from the method, it must be systematized.

Keep in mind that it can't be applied to every type of work. Some authorities recommend using "Control by Exception" only if:

- The exception doesn't turn up too late, that is, if remedial steps will still be inexpensive.

- You can set up a standard. To recognize an exception, you must be sure what "normal" activity is. In one company, for example, the executive set up a maximum of 5 percent rejects as "normal." If sub-standard material went above this figure, the matter called for immediate investigation.

- You can get a report of results. You must be able to arrange to have a subordinate inform you of irregularities. This way, your time isn't wasted in the unnecessary routine of checking everything.

III. Streamline

"Reports, reports, and more reports. Reports are making me snow-blind!"

You've undoubtedly heard one of the most common complaints made by executives with the detail problem: "Routine reports are the big time consumer."

For your own amazement, you might like to list all the reports that pass through your hands—either outgoing or incoming. Here's a sample list suggested by one executive:

Daily production record
Weekly production records
Monthly production records
Purchasing requisitions
Purchasing records
Payroll information
Subordinates' operating problems
Subordinates' written suggestions
Cost estimates
Progress reports
Development reports
Sales figures
Inventory reports
Operating cost figures
Special information

In your case that may be only a fraction of the report avalanche.

Anything you can do, therefore, to simplify the forms that pass over your desk—in either direction—is bound to cut down the load.

Of course, when forms originate with other executives, you may be limited to passing along your suggestions for simplification. But in most cases, they'll be receptive. They may have as much to gain as you do.

More

As Management Sees It

starting on page 231

Here's a brief checklist of standard methods used to streamline report forms. You may want to run through them quickly to see whether any can be used to advantage in the reports you handle.

☐ **Both sides?** It's often practical to use both sides of a card or sheet, thus reducing the size of the form by half. A two-sided form generally requires a heavier paper stock to avoid show-through.

☐ **Standard information?** Fill-in material that has to be entered repeatedly can sometimes be made part of the form itself. Check: department names or numbers, codes, symbols, etc.

☐ **Punching?** A spindle file, or binder may be the best way for you to file a given form or record. Prepunching of the form by machine makes this method of filing easier.

☐ **Scoring?** Perforation makes it possible to retain the essential part of a form, and discard the balance. Where two forms have to be kept together, only *temporarily*, scoring makes it possible to send each on its respective way.

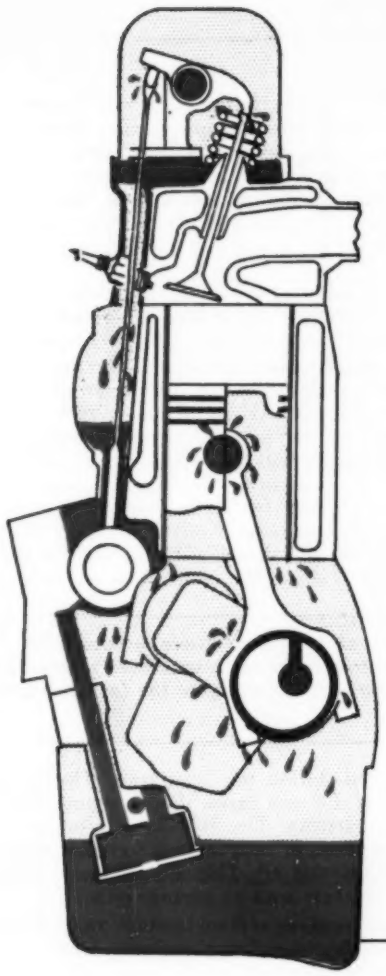
☐ **Check-mark entries?** Where the information required is a simple choice—Yes or No, for example, or Accepted or Rejected—it's easier to place check marks in a box than to write answers.

☐ **Vertical or horizontal?** Some information is better running up and down on a form, rather than reading from left to right. Addition and subtraction are easier if the figures are vertical. But entries that may have to be read after a form is filed will fare better running horizontally across the top of the form.

Up-to-Date?—

A periodic review of your executive workload is the surest way to keep the detail problem under control. Don't take it for granted that because you licked the job yesterday, you're rid of the problem today, or if you don't have the problem now, it won't be strangling you tomorrow.

And here's a final important point. Keep in mind that the detail that bogs you down can be a valuable ingredient of someone else's job. You can use routine duties as a means of training subordinates, preparing them for expanded duties, providing a testing laboratory for ideas and ingenuity. # #



Cross-Graded Motor Oils

GASOLINE is not the only product in for a "new look" because of the high compression ratio engine developments. Hot on the heels of the additive controversy is the subject of cross-graded or multiple viscosity graded motor oils. Anticipating the new engine developments, the refining industry has devoted considerable attention to the manner in which selection and compounding of lubricating oil stocks affect the fuel requirements of engines.

In general, the newer oils differ from conventional lubricants in that they are processed from distillate oils within relatively narrow distillation ranges. Since the viscosities of these fractions are considered low for automotive service, viscosity index improvers are usually added to increase the viscosity at engine operating temperatures. The viscosity index of the resulting oil is generally well above 100 and permits one formulation to meet the viscosity specifications for several different SAE grades. This is where the controversy comes in. Some refiners are very enthusiastic about the results of this trend; others are only lukewarm.

The big questions about the new oils are: Do they save gasoline? Do they reduce deposits and do they protect engines? In the succeeding three articles, you will find answers to these questions according to research programs of three leading companies.

How 10W-30 Motor Oil Performs

Claimed: This blend has been shown to have superior combustion chamber deposit properties, to have satisfactory oil consumption characteristics, and to maintain its viscosity and high viscosity index for normal periods of use.

R. L. Overcash, W. Hart and D. J. McClure,
Kendall Refining Company,
Bradford, Pa.

THE INTRODUCTION of multigraded motor oils was the result of years of development and testing by the petroleum industry. For the past year or so these products have been the subject of much discussion by not only the oil marketers but by the automotive industry and the oil buying public as well. Presented here is some recent information on three performance characteristics of this new family of crankcase lubricants. A comparison of conventionally compounded lubricants and multigraded oils with respect to combustion chamber deposits, oil consumption and viscosity change will be considered in that order. A presentation[1] before the SAE in January, 1954, included some of the work that will be summarized here. Additional information extending and adding to the earlier work is included.

Octane Requirement Increase

Laboratory Tests—Laboratory tests have been con-

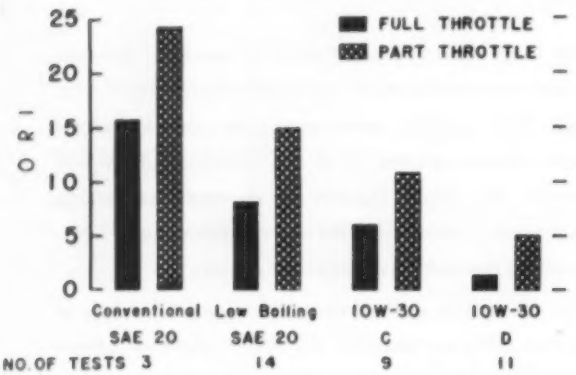


Figure 1. Improvements in octane requirement increase through the use of a selected base stocks and additive combinations.

ducted to determine the effect of oils in building up deposits in the combustion chamber. These tests utilized six-cylinder L-head engines operated on a light duty, four-minute cycle, with one minute of idling. The octane requirement of the engine is defined as the octane number of the fuel required for borderline spark knock.

Criteria by which the results are evaluated include both full and part throttle octane requirement increase, deposit weight and power loss. Figure 1 shows the octane requirement increase at full throttle and at part throttle for four oils. The conventional SAE 20 oil was compounded from a neutral-bright stock blend with inhibitor and detergent additives. This oil is similar to many commercial oils both in type of blending stock and additive treatment. The low boiling SAE 20 oil contained a very light neutral with VI improver and a detergent-inhibitor combination. Oil C (10W-30) was blended from carefully chosen neutral stocks and VI improver with selected additives. 10W-30 Oil D contained the same base stocks and VI improver and differed from Oil C only in the additive combination used. The reduction in octane requirement increase from 16 to 2 at full throttle and from 24 to 5 at part throttle shows that the 10W-30 Oil D is a real improvement over the conventional SAE 20 oil in its contribution to deposits causing octane requirement increase.

Figure 2 shows a reduction in combustion chamber deposit weight from 84 grams for the conventional oil to 37 grams for 10W-30 Oil D. Information with respect to the loss of full throttle power output during these tests is shown in Figure 3 and indicates a reduction in power loss from approximately 4 to 1.8 brake horsepower. These figures summarizing laboratory knock tests show significant improvements for this 10W-30 oil over the conventional SAE 20.

Road Tests—In order to check the beneficial results obtained with the 10W-30 oils in the laboratory, road tests were conducted using 8-cylinder high compression automobiles. The octane requirements for borderline spark knock and knocking surface ignition were determined periodically. A conventional SAE 20 oil and a 10W-30 oil are first compared on the basis of octane requirement increase for spark knock. Both oils were run in each car, with multiple tests in some instances. Figure 4 shows the octane requirement increase for sixteen tests in five cars. The octane requirement increase observed for the 10W-30 oil averages 6 numbers less than that found with the conventional oil. Figure 5 shows the equilibrium research octane number reached during the same tests. The actual equilibrium level of the cars varies due to engine differences and type of driving. The 10W-30 oil resulted in equilibrium octane levels in each car that were lower than those for the conventional oil. This improvement ranged from 2.5 to 10.0 numbers with an average of 5.5.

"The beneficial effects of multiple graded 10W-30 lubricants will contribute to more satisfactory operation of high compression cars operating on the fuels available today."

The tendency for knocking surface ignition, as evidenced by run-on, was also determined during the road tests after deposits had reached equilibrium. (Run-on, continuation of engine firing after the electrical ignition is turned off.) The octane requirement was defined as the research octane number of the fuel that allowed borderline run-on. The nature and variability of knocking surface ignition require many determinations to establish an average octane requirement. Figure 6 shows the results obtained in tests on a conventional oil and a 10W-30 oil in three cars. The bars show the range of values found during each test and the average value is indicated by a line crossing each bar.

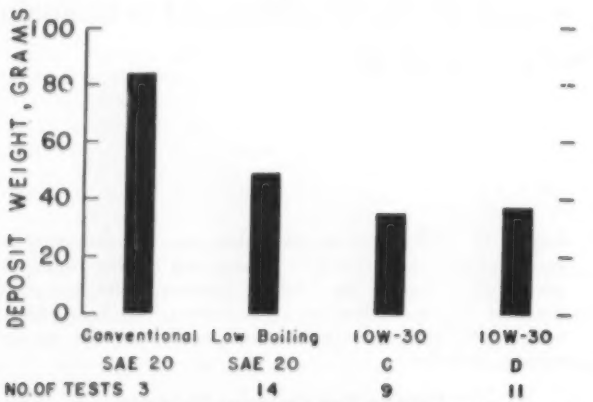


Figure 2. Reduction in combustion chamber deposit weight by means of selected base stocks and additive combinations.

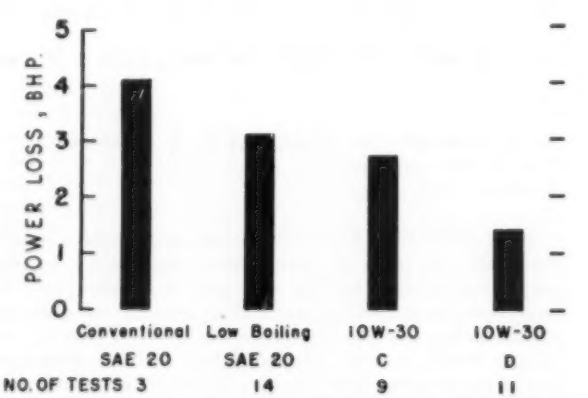


Figure 3. Reduction in power loss through use of selected base stocks and additive combinations.

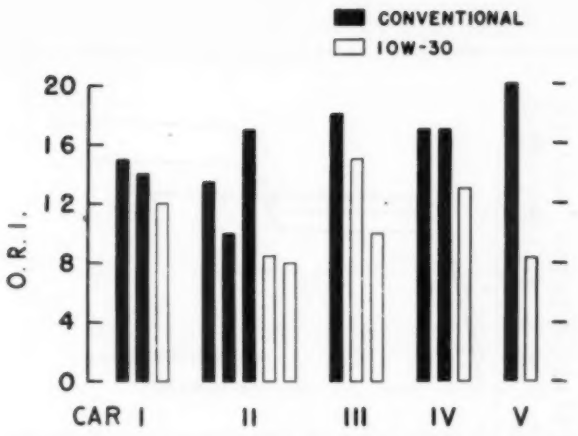


Figure 4. Effect of crankcase oils on octane requirement increase as determined during road test in high compression ratio passenger car engines.

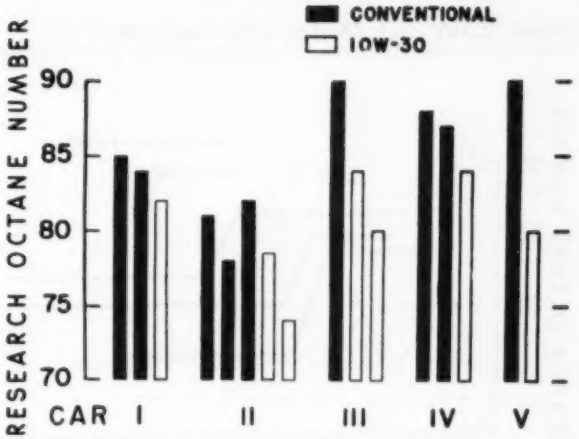


Figure 5. Effect of crankcase oils on the equilibrium octane requirement for borderline spark knock during road tests in high compression ratio passenger car engines.

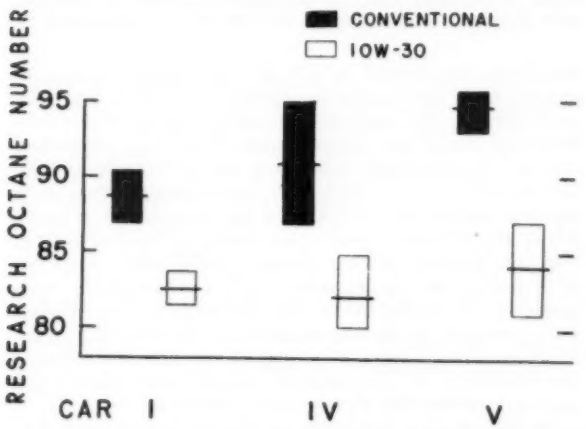


Figure 6. Effect of crankcase oils on octane requirement for borderline surface ignition as determined during road tests in high compression ratio passenger car engines.

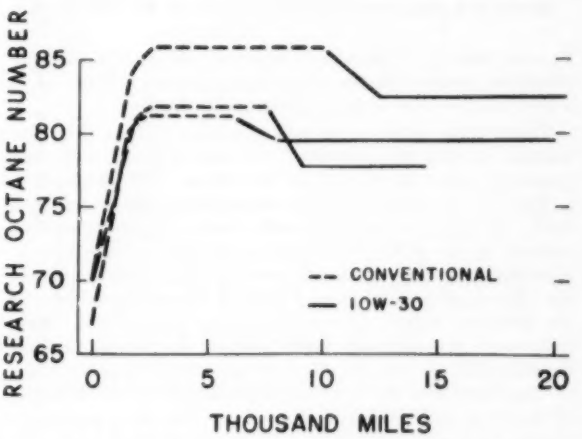


Figure 7. Beneficial effect on octane requirement for borderline spark knock of a change from a conventional oil to an SAE 10W-30 oil.

The 10W-30 oil shows an average advantage of 8.5 octane numbers in the suppression of knocking surface ignition.

From a practical standpoint, it was desirable to know whether or not it was necessary to start with a clean combustion chamber in order to gain the advantage found through the use of 10W-30 oils. To answer this question, three cars were run to deposit equilibrium on a conventional oil. The 10W-30 oil was then used as crankcase fill to determine its effect on the equilibrium requirement already established. Figure 7 shows an average reduction in spark knock requirement of 3 numbers. Figure 8 shows the effect of the 10W-30 oil on the octane requirement for surface ignition established by the conventional oil. The 10W-30 oil was able to lower the requirement by an average of 5.5 numbers.

Three similar tests were made using the 10W-30 oil to establish the initial equilibrium. The conventional oil was then used for crankcase fill. Figure 9 shows that the conventional oil caused an average increase of 3.5 numbers for borderline spark knock. Figure 10 shows an average increase of 4.4 octane numbers for the suppression of knocking surface ignition. The low octane requirement level associated with a 10W-30 oil could not be maintained when changing to a conventional oil.

Oil Consumption

Recently several presentations concerned the consumption characteristics of multiple viscosity graded motor oils.[2, 3, 4] The authors have also obtained laboratory and road test information on this interesting phase of oil behavior. In the laboratory, oil consumption experiments were made using full scale L-head engines operated at 3150 rpm, 30 brake horsepower for six hours. Oils were tested in a randomized block pattern in each of the experiments. Each experiment contained the same SAE 20 oil for reference. This oil had a viscosity of about 57 SUS at 210 F. Figure 11 shows the relative consumption of SAE 10W, 20 and 30 oils, along with a 10W-30 oil. Each of the data points represents three or more individual tests. By definition, the relative consumption of the SAE 20 oil at any level of consumption is 100 percent. On the scale at the bottom is plotted the actual oil consumption of the SAE 20 in quarts per calculated 1000 miles. It is logical that the SAE 10W and SAE 30 grades have relative consumption rates about parallel to the SAE 20 as shown. The 10W-30 oil, with a viscosity of about 60 SUS at 210

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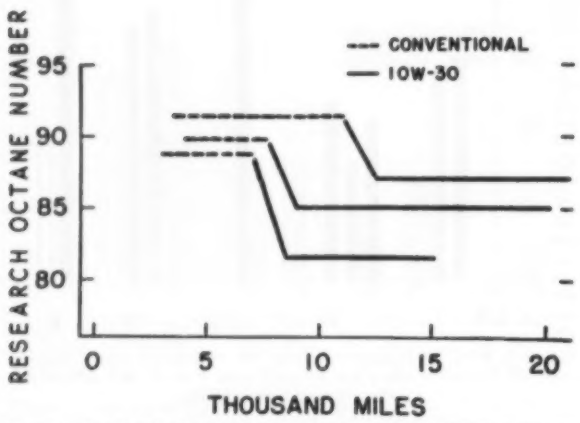

Figure 8. Beneficial effect on octane requirement for borderline surface ignition of a change from a conventional oil to an SAE 10W-30 oil.

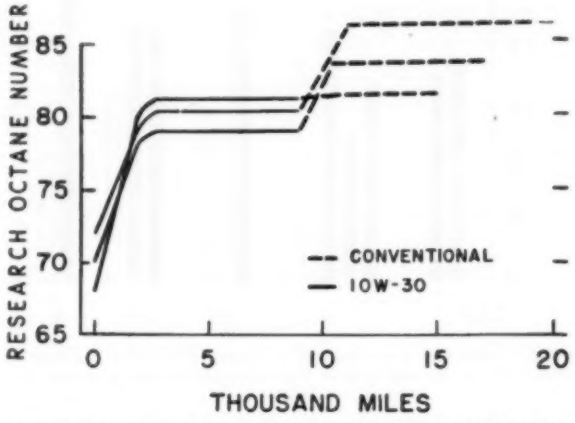

Figure 9. Detrimental effect on the octane requirement for borderline spark knock of a change from an SAE 10W-30 to a conventional oil.

F., was consumed at a high relative rate at low oil consumption levels. On the other hand, it was consumed at a low relative rate at high consumption levels.

These data raise a natural question, "Does this also happen in road test vehicles?" It does in both trucks and passenger cars. In Figure 12 are shown data obtained in a fleet of six bakery trucks used for intercity delivery. Each oil was run twice in each truck. The consumption pattern of the 10W-30 oil bears a striking resemblance to that shown in the previous figure. In Figure 13 are shown oil consumption data from a fleet of 12 passenger cars of six different makes operated by sales supervisors. These cars were divided into three groups, according to their consumption of SAE 20 oil. Each data point is the average of duplicate tests in four cars. Here again the relationship of the SAE 10W-30 oil to that of the SAE 20 is strikingly similar even though the actual level of consumption is somewhat different.

Change of Viscosity and Viscosity Index

The effect of engine operation on the viscosity index improver additives of multigraded oils is of prime importance. Change of both viscosity and viscosity index have been investigated in 10W-30 oils. Samples from laboratory CRC L-4 oxidation stability and FL-2 low temperature tests, as well as light duty cycling tests, were examined. Road test samples came from both trucks and cars in "over-the-road" and "stop and go" service. Where low temperature or light duty operation predominated, dilution masked any changes in the physical characteristics of the oil itself; producing greatly reduced viscosities and high viscosity indices. Dilution under these conditions is found to the same extent with conventionally compounded oils and 10W-30 oils. Consequently, a satisfactory approach to the investigation of the behavior of the oils themselves would be to remove the fuel and examine the remaining oil. The used oil samples were filtered and then stripped at 275 F. with carbon dioxide.

On Figure 14 is shown the change in viscosity at 210 F. found with 31 samples, all blended with the same VI improver. Mileage on the samples varied from 1000 to 3000 miles or its equivalent on the dynamometer. The data have been divided into three catgories according to the type of service involved. Those data designated "road" are from high speed, high load "over-the-road" tests. The "laboratory" data are from high temperature laboratory tests. Those data designated "S. and F." are from stripped

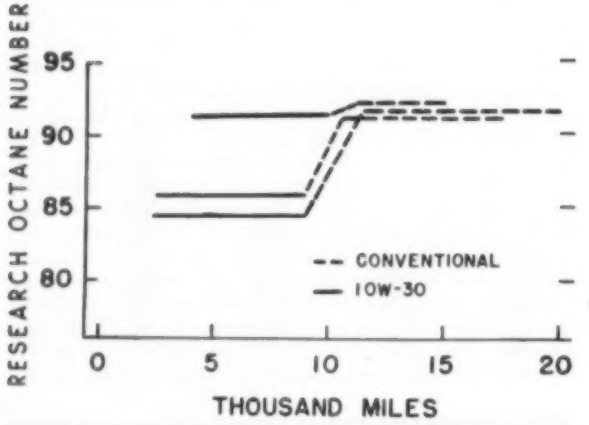

Figure 10. Detrimental effect on the octane requirement for borderline surface ignition of a change from an SAE 10W-30 to a conventional oil.

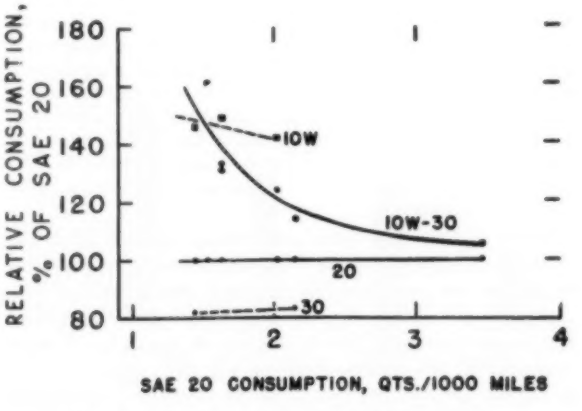

Figure 11. Relative oil consumption laboratory tests.

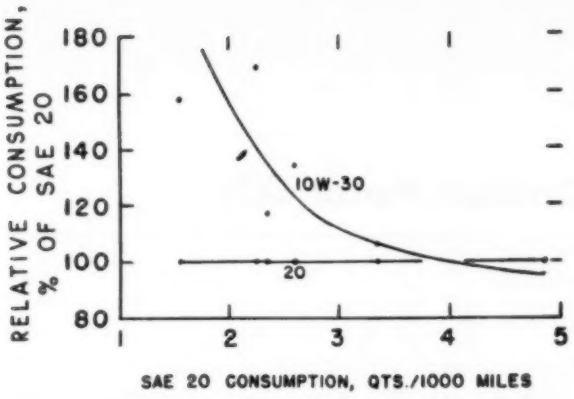

Figure 12. Relative oil consumption in road test with bakery trucks.

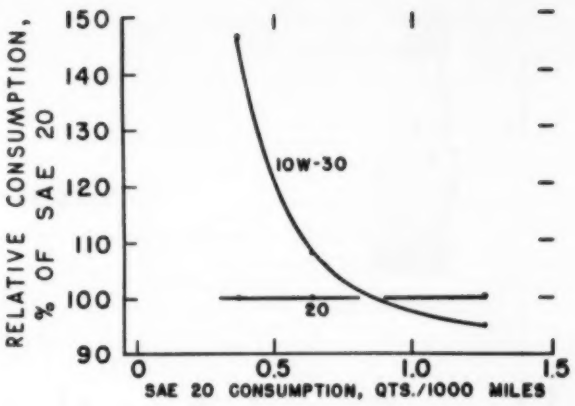

Figure 13. Relative oil consumption in road test passenger cars.

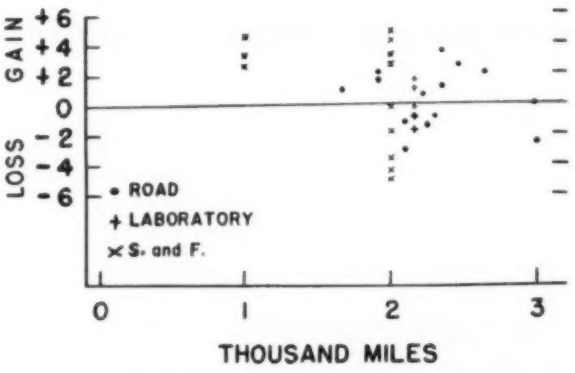

Figure 14. Change in viscosity of SAE 10W-30 oils.

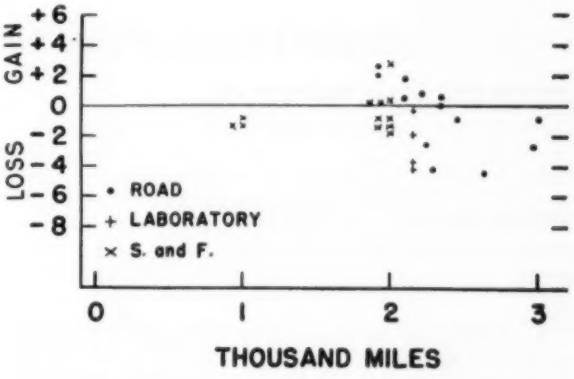

Figure 15. Change in viscosity index of SAE 10W-30 oils.

and filtered samples from low temperature, light duty tests run both in the laboratory and on the road. None of the oils lost more than 4.9 SUS or gained more than 4.4 SUS @ 210 F. in approximately 2000 miles. The average change was a loss of 0.3 SUS. The use of VI improvers less stable to shear would have shown greater viscosity losses. Data from 12 samples of conventionally compounded oils (not shown in Figure 14) which were run under the same types of services showed an average gain in viscosity of 2.8 SUS at 210 F. with values ranging from a gain of 1.0 to a gain of 5.2 SUS. Data have been obtained which show that changes of this magnitude in this viscosity range will not significantly affect the consumption characteristics of the oil.

Change in viscosity index of the same samples is shown in Figure 15. (The data marked "S. and F." were all from 1000 or 2000 mile samples. Where the same change for two or more samples was found, the data were offset in this figure.) These data show a maximum loss of 7.5 VI units and a maximum gain of 2.6 VI units in the group of 31 10W-30 samples. The average change was a loss of 0.8 VI units. The new oil viscosity indices ranged from 138 to 145. Twelve samples of conventionally compounded oils of approximately 105 VI discussed previously in the viscosity change section, exhibited an average gain in VI of 2.2 units. The individual values ranged from a gain of 4.5 units to a loss of 6.6 units.

The cold starting characteristics of lubricants can be estimated from their viscosity at 0° F. The 0° F. viscosities of the samples examined ranged from 5500 to 12,000 SUS. All of these oils were within the SAE 10W range after usage and therefore, offer cold starting characteristics similar to the new oils.

An SAE 10W-30 oil blended from carefully selected components has been shown to have superior combustion chamber deposit properties, to have satisfactory oil consumption characteristics, and to maintain its viscosity and high viscosity index for normal periods of use. The beneficial effects of multiple graded 10W-30 lubricants will contribute to more satisfactory operation of high compression cars operating on the fuels available today.

Original presentation of this paper was at the annual meeting of the National Petroleum Association, Atlantic City, September, 1954. # #

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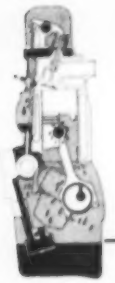
[4] *The Performance of High VI Motor Oils*, Fleming, Geddes, Hakala and Weisel—SAE Quarterly Trans. 4 419 (1950)

Cross-Graded Motor Oils



Cross-Graded Motor Oils

How Good Are the "New" Motor Oils?

Claimed: They can be good, but not so good that a "new era" in engine lubrication has been introduced.

Carl W. Georgi,

Quaker State Oil Refining Corporation,
Buffalo, N. Y.

AT A RECENT meeting on new developments in crankcase oils, it was claimed that "a new era in the lubrication of automotive engines has been inaugurated." According to advertisements, these "new era" motor oils will provide large reductions in combustion chamber deposits and engine knocking tendencies; remarkable reductions in engine wear; and phenomenal increases in fuel economy. And for good measure, they're frequently claimed to give more engine power, less oil consumption, greatly improved engine cleanliness, and so on. That's an impressive list of beneficial properties.

So, two questions of obvious interest these days are (1) can motor oils really do all these things? and (2) will the motoring public actually be able to detect any of these claimed improvements in the every-day operation of their cars? In other words, has a "new era" in motor oils really arrived?

Combustion Chamber Deposits and Engine Knock—Figure 1 illustrates the trend in compression ratios of the later model American passenger car engines. It's interesting to note that in 1950, just 4 years ago, only two engine makes had compression ratios of 7.5, which represented the highest at that time. In 1954, 22 engine models had compression ratios of 7.5 and higher, with eight of these makes having ratios between 8.0 and 8.7.

This automotive trend to higher and higher compression ratios is the primary reason combustion chamber deposits and the engine "knock" problem have become of such predominant interest within the past few years. Naturally, as a combustion chamber deposits aggravate engine knocking tendencies, the gasoline octane requirement of the engine to maintain knock-free operation is increased. If an engine with deposits develops an octane requirement exceeding the octane number of commercially available gasolines, a real problem develops for everyone concerned.

Figure 2 indicates the magnitude of this deposit-octane requirement increase problem. Combustion chamber deposits and octane requirement build up quite rapidly during the first few thousand miles of operation of a new or clean engine. Beyond this point, the rate at which deposits break loose or burn off tends to equal the rate at which any new deposits are formed. Combustion deposits and octane requirements thus reach a maximum and tend to remain fairly constant after some 3000 to 5000 miles. With favorable operating conditions, this requirement increase may be in the order of about 3 to 8 octane numbers, while unfavorable operating conditions may cause requirement increases ranging up to 14 octane numbers.

Combustion deposits and "knock" involve four major factors: (1) gasoline (2) motor oil (3) engine operating conditions, and (4) engine design.

The gasoline used to make an engine run obviously has a vital bearing on engine performance and on the "knock problem." But this discussion is confined to the subject of motor oils.

In considering motor oils, combustion deposits and engine knock have often been blamed on oil geography, that is, where the crude petroleum came from; or on oil composition, whether predominantly paraffinic, naphthenic, aromatic or asphaltic in type. But these factors are now recognized to have no direct significance. The predominant property of motor oils in this combustion deposit and knock problem is volatility or distillation range. The more volatile a motor oil in its distillation range, the less it will contribute to deposit build-up in engine combustion chambers. Unfortunately, however, if a motor oil contains excessively volatile fractions in its make-up, it will have undesirably high consumption tendencies in engines—a shortcoming motorists will not tolerate. So the balance between

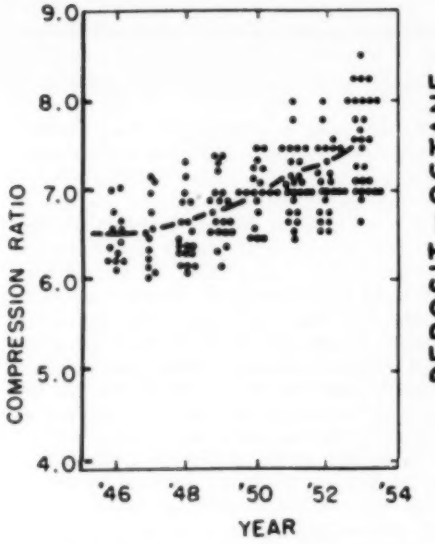


Figure 1. Compression ratios of post-war American passenger car engines: A real problem to motor oils.

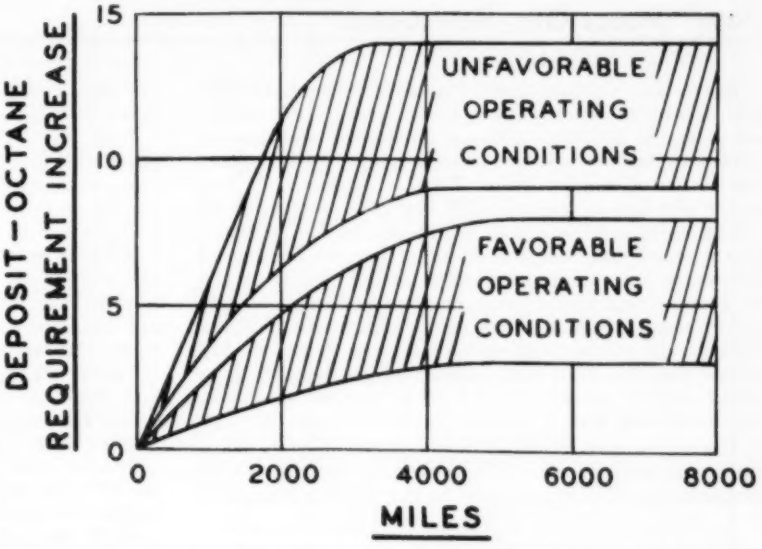


Figure 2. During the first few thousand miles: A rapid build-up of chamber deposits and octane requirement in a typical engine.

oil volatility and combustion deposits must be a compromise. That is, the highest possible volatility, consistent with the limitations necessitated by low oil consumption characteristics.

The "new era" motor oils represent the best possible commercial approach to this compromise. They're made of close-cut petroleum distillates, which are carefully fractionated to eliminate heavy ends as well as excessively volatile light ends. The natural viscosities of these close-cut distillates are quite low, usually in the SAE 10W or 5W viscosity ranges, so they have to be built up in viscosity by the addition of oil soluble synthetic resins. These resinous additives also increase the Viscosity Index of the resulting oils, so that they can be made to meet the viscosity specifications for several SAE grades. The "new era" motor oils might thus be defined as multi-viscosity graded oils, most usually of either SAE 5W-20 or SAE 10W-30 rating. They consist of close-cut distillates compounded with viscosity and viscosity index increasing resins, as well as with detergent, inhibitor and other types of reinforcing additives as commonly used in *all* better quality motor oils.

What might be called the "old-fashioned" motor oils are petroleum lubricating fractions of quite wide distillation range, so as to include constituents of low volatility and higher natural viscosity. They may be straight high boiling range distillates, or they may be blends of distillate oils and residual bright stock; plus inhibitor, detergent and the other types of reinforcing additives. The important feature is that they can be made with high natural viscosities, so that viscosity-building additives are not necessary.

For a quick differentiation, we might say that the "new era" motor oils are of the volatile type, whereas the "old-fashioned" oils are of the low volatility type.

Of course, the big question is: How much better are volatile type oils in minimizing combustion chamber deposits and engine knock troubles, as compared to low volatility oils? This question involves not only motor oil characteristics, but also engine operating conditions, and engine design.

Passenger cars which are used in mixed town and country operation do not seem to indicate any significant differences between volatile type and low-volatility oils insofar as engine knock or octane requirement increase is concerned. The appearance and texture of the combustion deposits may vary with different types of oils, but the end effects on engine performance and octane requirement seem to be substantially the same.

One of the most confusing features of present-day gasolines and motor oils, as they relate to the combustion deposit and engine knock problem, has been the conflicting test data reported by various investigators. Part of the reason for this may be that the factor of engine operating conditions has not always been adequately considered, and that many test programs were conducted in only one or two makes of engines. Engine operating conditions are of major significance, and differences in engine design are also an important factor, as will be discussed later. Table 1 lists what is indicated to be a reasonably accurate summary of the oil-deposit-knock problem, based on a considerable amount of test data from the leading makes of late model engines.

With the more favorable types of operatign conditions, where engines are occasionally (or frequently) run hard enough to burn off excessive combustion chamber deposits, motor oils of even widely varying types evidently cause little or no differences in engine knocking tendencies or in gasoline octane requirement. It is only under the unfavorable conditions of extended stop-start urban operation, where low engine temperatures prevail much of the time, that the combustion deposit-forming tendencies of oils really become significant. Under such light duty driving conditions, volatile type oils can mean a saving of some three to six numbers in octane requirement for knock-free operation.

It is interesting that engine octane requirement increases may range up to nearly 10 octane numbers, even with oils of minimum combustion deposit-forming tendencies, whereas motor oil alone can save little more than three

Cross-Graded Motor Oils

to five octane numbers under the most unfavorable light duty driving conditions. But in many instances, this saving can mean the difference between satisfactory and unsatisfactory engine performance. Which brings up the important factor of engine design. Table 2 summarizes a few engine test data to illustrate this highly important factor.

Engines A and B are both V-8 models of similar horsepower rating and compression ratio. Largely because of differences in combustion chamber design, Engine A has an octane requirement averaging five to seven numbers higher than Engine B. With heavy combustion chamber deposits, the octane requirement of Engine A may readily exceed the octane levels of commercial gasolines. A three octane number saving with a volatile type motor oil can thus be of real benefit in many engines of make A.

The octane requirement of Engine B remains well below the octane levels of many present-day gasolines, even with accumulation of heavy deposits, so that engines of make B display little significant anti-knock benefit from volatile type motor oils.

"It is interesting to note that engine octane requirements may increase up to ten octane numbers, depending on driving conditions, even with oils of minimum deposit-forming tendencies, whereas motor oil alone can save little more than three to five octane numbers under the most unfavorable light duty driving conditions."

The 1953 model of Engine C also has a very high average octane requirement, and with heavy combusiton chamber deposits may develop knocking troubles with the highest octane commercial gasolines. Again, a three or four octane number saving with volatile type motor oils can be of real significance in many 1953 engines of make C. The 1954 model of Engine C has a considerably altered combustion chamber design, with the result its average octane requirement is considerably lowered. This 1954 design will apparently give satisfactorily knock-free operation, even with heavy combustion deposits and with commercial gasolines, so that it is not sensitive to the motor oil volatility factor.

Piston Ring and Cylinder Wear—Piston ring and cylinder wear ultimately leads to high oil consumption, and a high oil-consuming engine is popularly regarded as "worn out," even though it may otherwise be performing quite satisfactorily. As a result, rings and cylinders are usually considered as the most sensitive wearing surfaces of engines.

Ring and cylinder wear results from three causes: abrasion, corrosion, and erosion. Abrasive wear results from dust and dirt drawn into the engine. Corrosive wear results from rusting and chemical attack of the metal surfaces by acidic constituents formed during the combustion of gasoline. Corrosive wear occurs predominantly in cold engines immediately after they are started and during warm-up. Cold engine surfaces condense moisture and acidic constituents from the combustion gases, to foster the corrosive or chemical type of wear. Once an engine is warmed up, these corrosive constituents are not condensed so readily and tend to be blown out the exhaust. Corrosive wear is thus a problem associated with engines used primarily in stop-start urban service.

Erosive wear is caused by metal-to-metal contact, and results from an inadequate supply of oil to form a protective lubricating film, or from oil films which do not provide adequate anti-erosion or anti-wear properties.

Considering motor oils and their relation to ring and cylinder wear, abrasive wear caused by dirt and dust cannot be overcome by oil. The only correctives are efficient carburetor air cleaners, crankcase breather air cleaners, and crankcase oil filters; plus the important item of oil drains at reasonable intervals to flush out abrasive contaminants before they build up to dangerous concentrations.

However, motor oils do have an important relation to the corrosive and erosive types of engine wear. Fortunately, many of the most efficient detergent additives as used in better quality motor oils are also highly effective as anti-rust and acid-neutralizing agents. In the same way, many of the most efficient inhibitor additives as used in better quality motor oils are also excellent anti-wear or anti-erosion agents. As a result, the better motor oils of the type usually designated "For Service MS or DG" are not only detergent type but are also effective as anti-corrosive and anti-erosive agents. Such oils can reduce ring and cylinder wear very significantly as compared with straight mineral oils containing no reinforcing additives.

However, motor oils with improved anti-wear properties are only part of the story. While the petroleum industry has been active in developing better oils, the automotive engineers, the metallurgists, and the piston ring manufacturers have not been idle. During the past decade, many engine improvements have been made, but seemingly without the recognition they deserve. As just one example: piston rings have been greatly improved in recent years. Compression rings with special surface coatings have greatly improved wear-resisting properties, and the newer designs of highly flexible oil rings will maintain efficient oil control even though considerable wear does

TABLE 1
Average Engine Octane Requirement Increase (O. R. I.) From Combustion Chamber Deposits

	O.R.I. with Volatile Type Oils	O.R.I. with Non-Volatile Type Oils	Octane Saving with Volatile Type Oils
Constant Speed, Constant Load	2-3	2-3	Nil
Heavy Duty, High Load	3-5	3-5	Nil
Cross-Country	4-6	4-6	Nil
Mixed Cross-Country and Urban	6-8	6-8	Negligible
Urban Only	7-9	12-14	3-5

TABLE 2
Relation of Engine Design to Combustion Deposits and "No-Knock" Octane Requirement

ENGINE MAKE	New (Clean) Engine Octane Requirement	Octane Requirement With Heavy Deposits	Maximum Octane Requirement Increase
"A"	85	96	11
"B"	80	89	9
"C" (1953 Model)	85	97	12
"C" (1954 Model)	81	91	10

develop on the ring or cylinder surfaces.

Although motor oils, when adequately compounded with reinforcing additives, will contribute to less ring and cylinder wear, they can't be given all the credit. Improvements in engine designs fully equal the improvements which can be incorporated in oils. The combination of better engines and better oils is what really produces less wear and longer engine life.

Camshaft and Valve Lifter Wear—Camshaft and valve lifter wear has recently become a problem of major importance, as the result of the current trend to engines of higher efficiency and horsepower. Just a few years ago, the average passenger car engine had a maximum horsepower rating equal to about .45 to .5 horsepower per cubic inch of piston displacement. Many of today's engines have maximum ratings equal to .65 to .75 horsepower per cubic inch displacement. An increase of nearly 50 percent. Many features of engine design are involved in this greatly involved power and efficiency, and just one phase is improved valve action to provide better engine volumetric efficiency. This has involved larger valves, higher valve spring pressures and camshafts which produce faster valve opening and closing. These design changes have created greatly increased pressures at the points where the camshaft lobes rub against the faces of the valve lifters. This camlifter rubbing area has always been a point of very high pressures, but in many of the newer engines, these pressures have now become so high that some motor oils no longer have adequate anti-wear properties to prevent severe cam and lifter wear.

Wear failure of camshafts and lifters can develop within just a few thousand miles with inadequate motor oils, so that this problem can be more serious as far as engine life is concerned, than ring and cylinder wear. It's also interesting that engine load has little effect on cam-lifter rubbing pressures. And low or moderate engine speeds actually involve higher pressures than high engine speeds. Cam and lifter wear is thus a potential problem under all types of operating conditions.

Unfortunately, the type of anti-wear properties necessary in motor oils to prevent cam and lifter wear are not necessarily the same as the anti-wear properties which will minimize piston ring and cylinder wear. As a result, many motor oils which are very effective in minimizing ring and cylinder wear, can be badly deficient in preventing cam and lifter wear.

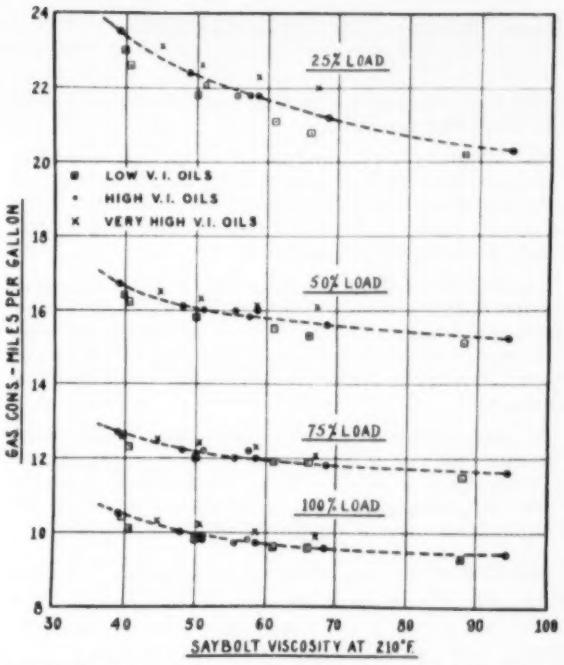


Figure 3. Viscosity and Viscosity Index: How they affect fuel consumption.

Table 3 summarizes a number of interesting items relating to oils and the cam-lifter wear problem. The viscosity and type of the base oil in a motor oil can have a marked effect on cam and lifter wear tendencies. Oils 1 and 2 listed in Table 3 were both high V. I., low volatility oils of SAE 20 viscosity grade. Both were straight mineral oils and contained no additive treatment. The oil containing Bright Stock was much superior in minimizing valve lifter failure, compared to the straight distillate type oil of similar viscosity.

Oils 3 and 4 in Table 3 were of the volatile distillate type compounded with viscosity and V. I. building resins. They contained no other additive treatment. Both of these oils caused a very high incidence of lifter pitting. Bright Stock is evidently a very effective anti-wear agent, whereas V. I. improver additives seem to be largely ineffective.

Referring to oils 5 through 10 in Table 3, the addition of 1 percent of an "anti-wear" additive to the SAE 20 oil containing Bright Stock produced a perfect rating with no failed lifters. On the other hand, addition of 1 percent of this same "anti-wear" additive to the SAE 10W-30 oil effected but limited improvement. Two percent of the "anti-wear" additive was necessary in this 10W-30 oil to achieve a perfect lifter rating. Experience seems to indicate that volatile type oils require much heavier reinforcement with "anti-wear" additives than do low volatility oils which have better intrinsic viscosity properties.

Another interesting complexity in the cam and lifter wear problem is illustrated by oils 11 and 12 in Table 3. The incorporation of this particular inhibitor and detergent additive combination in the SAE 20 base oil, to make a typical detergent oil of the MIL-2104 level, caused a marked loss of lifter anti-wear properties, although this

TABLE 3
Typical Engine Test Results on Valve Lifter Wear

	TYPE OF MOTOR OIL	Lifters Failed (Pitted)	Lifters Okay
1	SAE 20 Base Oil (Containing Bright Stock)	3	13
2	SAE 20 Base Oil (100 Percent Distillate Type)	7	9
3	SAE 5W-20 Base Oil	13	3
4	SAE 10W-30 Base Oil	14	2
5	SAE 20 Motor Oil (Containing Bright Stock)	3	13
6	Same Plus 1 Percent Anti-Wear Additive "A"	0	16
7	SAE 10W-30 Motor Oil	14	2
8	Same Plus 1.0 Percent Anti-Wear Additive "A"	8	8
9	Same Plus 1.5 Percent Anti-Wear Additive "A"	4	12
10	Same Plus 2.0 Percent Anti-Wear Additive "A"	0	16
11	SAE 20 Base Oil (Containing Bright Stock)	3	13
12	Same Plus MIL-2104 Additive Treatment "B"	10	6

TABLE 4
Camshaft and Lifter Combinations in Typical Current Model Engines

CAR MAKE	A	B	C	D	E
Camshaft Metal	Steel	Steel	Alloy Iron	Alloy Iron	Alloy Iron
Lifter Metal	Chilled Iron	Alloy Iron	Steel	Chilled Iron	Alloy Iron

Cross-Graded Motor Oils

oil did have excellent piston ring and cylinder wall anti-wear characteristics.

Still another complicating factor in the cam and lifter wear problem relates to engine design; one phase of which is the materials from which camshafts and valve lifters are made. Table 4 lists the combinations in a typical group of current model engines.

Camshaft-valve lifter combinations of differing metals and metallurgy sometimes impose quite different requirements on the motor oil. Certain types of "anti-wear" additives may be highly efficient with some cam-lifter combinations, but quite ineffective with other cam-lifter combinations.

All these complicating factors mean that a large amount of engine test work is necessary to assure a proper balance of reinforcing additives of all the different varieties needed in present-day motor oils—whether they're of the volatile, or of the low volatility types.

Motor Oils and Gasoline Consumption—Can some motor oils provide large increases in fuel economy and "miles per gallon"? That's a question of obvious importance to every oil marketer, and to the motoring public. The numerous motor oil advertising campaigns of recent months, which acclaim gasoline savings up to 20 percent and more, have made this question of more interest than ever.

The only significant properties of motor oils relating to engine fuel consumption are viscosity and viscosity index. So the question then becomes: how much will these properties affect fuel consumption? Figure 3* illustrates some typical effects of oil viscosity and V. I. on engine fuel consumption, as determined by dynamometer tests under a wide variety of engine speeds and loads, and with much greater precision of measurement than is possible on the road. The various oils tested ranged from SAE 5W through SAE 50, and from very low V. I. to very high V. I. oils of the multi-viscosity type.

"Accurate engine power determinations on laboratory dynomometer test stands indicate that different types and varieties of motor oils (or of oil additives) have an insignificant effect on engine power output."

On the average, a change of one SAE viscosity grade produced a change of about 2 or 3 percent in "miles per gallon." Thus, an SAE 10W oil might be expected to provide some 5 or 6 percent more "miles per gallon of gas" than an SAE 30 grade. However, these tests were run with a thoroughly warmed-up engine, and with crankcase oil temperatures of 160 F. and higher. This raises the question whether engines used in stop-start service, where much lower crankcase oil temperatures prevail most of the time, might not show much larger gains in fuel economy with multi-viscosity oils of low over-all viscosity, and high viscosity index. This introduces another complicating factor—the effect of engine operating conditions on fuel consumption. Table 5 summarizes typical road test data, which illustrate this very important, but frequently overlooked factor.

TABLE 5
Typical Road Tests Illustrating Effects of Operating Conditions on Fuel Economy

TYPE OF DRIVING	MILES PER GALLON	
	Typical SAE 30 Oil	Typical SAE 5W-20 Oil
Cross-Country	20.2	20.8
City (Warm Engine)	15.4	15.6
Cycles of: 8 Miles City Traffic—4 Hours Parking	9 to 11	9 to 11

* "Some Effects of Motor Oils and Additives on Engine Fuel Consumption" SAE Transactions, Vol. 62, 1954, pages 385-391.

In steady cross-country operation, this test car averaged 20.2 miles per gallon with a typical high V. I. SAE 30 oil, and 20.8 miles per gallon with a typical SAE 5W-20 oil, only a 3 percent increase. The same car in stop-start city operation, after sufficiently long runs to warm up the engine thoroughly, averaged 15.4 miles per gallon with the SAE 30 oil and 15.6 miles per gallon with the SAE 5W-20 oil—an almost negligible difference.

This same car was then operated in typical city traffic in mild winter weather (30 to 50 F.) on a schedule involving start from cold and running for eight miles, followed by parking for a minimum of four hours, followed by another cold start and eight-mile city drive, another cooling period and so on. This test routine was intended to simulate cars used only for driving to work or similar intermittent short-run city operation. Under these conditions, gasoline consumption ranged from 9 to 11 miles per gallon with a variety of oils ranging from SAE 5W up through the SAE 30 viscosity grades. The difference between 9 and 11 miles per gallon (quite a percentage difference) related not to the viscosity or viscosity index of the motor oils used, but to the atmospheric temperature. The colder the weather, the poorer the gas economy under these short-run, cold operating conditions. Oil viscosity had no relation to fuel consumption, and in numerous instances the poorest gas mileage was encountered with the lightest oils. Atmospheric temperature and engine warm-up time were the controlling factors.

Regardless of what type of motor oil might be in the crankcase, an engine still has to have a carburetor. And carburetors are very sensitive to temperatures and engine operating conditions. Lower atmospheric temperatures, cold engines, engine warm-up, and stop-start driving all require carburetors to deliver rich mixtures and poor fuel economy. Engine operating conditions, and the effect they have on carburetion, can make a difference of over 100 percent in "miles per gallon." Differences in motor oils, even under the most favorable conditions, can produce only a fraction of this change. Fuel economy as affected by motor oils is thus readily obscured by the much greater effects of engine operation conditions. A recent "uncontrolled" road test program offers interesting confirmation. Some 100 car owners were merely asked to keep a record of their car mileages, gasoline, and oil consumption, while using free samples of typical low volatility oils of SAE 20 and SAE 30 grades, and typical multi-viscosity oils of the 5W-20 and 10W-30 types. The results of this survey varied all the way from 28 percent poorer gas economy with the multi-viscosity type oils, up to 34 percent increase in miles per gallon with an over-all average improvement of only 0.4 miles per gallon. It's readily understandable, therefore, that uncontrolled road tests, and the experiences of the motoring public, may

show wide variations in miles per gallon. But these differences are indicated to relate far more to the driving conditions than to the oil used, even though the oil is often given the credit (or the blame). Although motor oils of high viscosity index and lower average viscosity can produce limited improvements in fuel consumption, it's doubtful if the motoring public will be able to detect significant benefits, because of the much greater effects of driving conditions on fuel consumption. Day to day changes in atmospheric temperatures, and occasional or frequent changes in how the car is used, can readily cause considerably greater differences in "miles per gallon" than those afforded by different types of motor oils.

Motor Oil Consumption—Oil consumption is the only property of motor oils which can readily be measured by motorists, and it's well known the motoring public doesn't like high consuming oils. As a result, refiners are constantly striving to make motor oils of lowest possible consumption tendencies.

At the same time, the automotive and piston ring manufacturers have been developing better piston and ring designs, which maintain better oil control, and for much longer mileages. Figure 4 is a typical illustration. High speed oil consumption results from some old test records on a 1941 model of Engine R are shown. Similar tests on a group of very similar oils were run on a 1953 model of this same engine make. The engine improvement in consumption tendencies is noteworthy. It's also interesting that the late model design is much more tolerant of oils of lower viscosity.

The consumption resisting properties of well-made oils is due to refining and formulation improvements, but in the final analysis, engine design improvements are also a major factor. A large part of the success of present-day oils (including the multi-viscosity type) in maintaining low consumption properties is due to the automotive and piston ring manufacturers, even though they haven't received much credit.

Motor Oils and Engine Power—For many years, a favorite advertising theme for numerous crankcase additives has been "more engine power." Here of late, this same theme has also been used for a number of motor oils.

Accurate engine power determinations on laboratory dynomometer test stands indicate that different types and varieties of motor oils (or of oil additives) have an insignificant effect on engine power output. Even a few degrees difference in carburetor intake air temperature, or in spark timing, or carburetor air-fuel ratio can readily cause a much greater difference in engine power than do various motor oils or additives.

Summary—Answering the question posed by the title "How good are the new type motor oils?" it might be said that they can be good, but not so good that a "new era" in engine lubrication has been introduced. To summarize:

(1) The newer volatile type multi-viscosity oils can provide a saving of some three to five numbers in engine octane requirement for knock-free operation, under conditions of prolonged stop-start service. In certain engine designs having higher than average octane requirements, this octane saving with volatile type oils can be quite important. With more favorable operating conditions, where engines are occasionally or frequently run hard enough to burn-off excessive combustion chamber deposits, motor oils of even widely varying types evidently cause little or no differences in engine knocking tendencies, or in gasoline octane requirement.

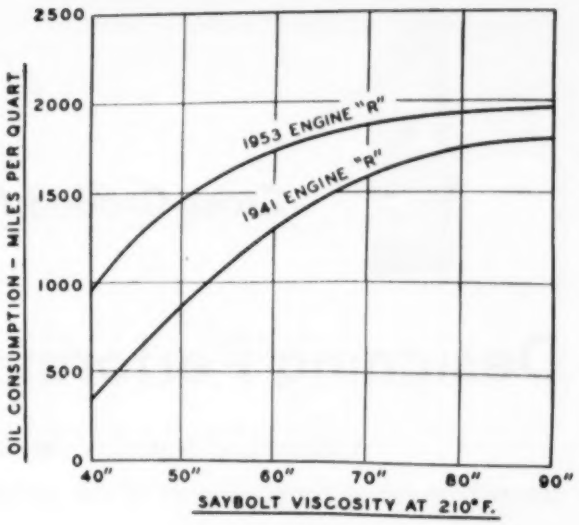


Figure 4. Oil consumption: A big improvement from engine design.

(2) Camshaft and valve lifter wear may be a greater problem with volatile type oils, unless they are heavily fortified with proper anti-wear additives to compensate for their lower intrinsic viscosities.

(3) When adequately compounded with reinforcing additives, both the volatile and low volatility type oils will contribute to low cylinder and ring wear. However, improvements in engines fully equal the improvements which can be incorporated in oils. The combination of better engines and better oils is what really produces less wear and longer engine life.

(4) Although the multi-viscosity volatile type oils can produce limited improvements in fuel consumption, it's doubtful if the motoring public will be able to detect significant benefits, because of the much greater effects of driving conditions on fuel consumption. Day to day changes in atmospheric temperatures, and occasional or frequent changes in how a car is used, can readily cause considerably greater differences in "miles per gallon" than those afforded by different types of motor oils.

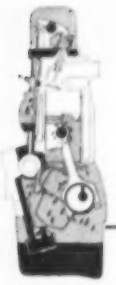
(5) Motor oils of either the volatile or low volatility types can be made to have low consumption tendencies. Improved piston and ring designs have also aided greatly in minimizing oil consumption tendencies.

(6) Motor oils have little effect on engine power output. Demonstrations which may indicate the contrary can be quite misleading when power comparisons are made between a cold or cooled-off engine and then after the engine is thoroughly warmed-up.

(7) The newer volatile type multi-viscosity oils are best suited for certain designs of high octane requirement engines, when they are used predominantly in very light duty stop and start service. Such oils do not seem to indicate any outstanding benefits in engines of more modest octane requirement, or in engines used frequently in heavier or cross-country service.

This discussion was condensed from the original presentation at the annual meeting of the National Petroleum Association, Atlantic City, September 16, 1954. # #

Cross-Graded Motor Oils



Cross-Graded Motor Oils

Designing Performance Into Motor Oil

Claimed: Oil-quality can best be achieved by concentrating attention on the performance requirements of the gasoline engines now in service and to be built, and by disregarding arbitrary classifications of specifications which impose undesirable limitations.

Leonard Raymond, New York
J. F. Socolofsky, Paulsboro, N. J.
Socony-Vacuum Oil Company, Inc.

IN THE SPRING of this year (1954) a completely new cross-graded engine oil was introduced by Socony-Vacuum Oil Company, Inc. This was not its first experience with such oils, a cross-graded SAE 10W-20 engine oil having been successfully marketed for approximately three years, starting shortly after the end of World War II. However, aside from the multiple-viscosity grading, the new oil differed in a number of ways from the earlier product.

These differences arose largely from the fact that the progress represented by the new post-war automotive engines was not exempt from difficulties in the form of some challenging technical problems involving fuels and lubricants. These problems required solution if the potential benefits of higher efficiency, better performance, longer life and greater customer satisfaction inherent in the new engine designs were to be realized.

A study of the many facets of the complex engine-fuel-lubricant interrelationship led to the conclusions that the lubricant could have an important role in solving these problems but that radical departures from conventional engine oil formulations and technology would be necessary if the desired objectives were to be accomplished. The major objectives of our new oil development:

- Reduced knock, preignition and spark-plug misfiring.
- Reduced mechanical and corrosive wear.
- Increased engine cleanliness.
- Improved viscosity, volatility and pour-point characteristics to achieve the combination of low oil consumption at high temperatures, easy starting at low temperatures and improved fuel economy.

In designing the new oil to accomplish these objectives, there was strong conviction that, since oils are made to lubricate engines in service and since performance requirements chance as engines and operating factors change, the criteria of quality should be performance in engines. The development was to be unhampered by arbitrary conformity to any established classification or traditional thinking on oil formulation. In following this principle, it was recognized that some temporary commercial difficulties might be encountered in this pioneering action due to the conflicts with tradition and established recommendations based on conventional oils.

However, it was hoped that the expected fine performance of the new type of engine oil in service would again demonstrate that a changing technology in a free economy requires flexibility in thinking by equipment builders, users and standardization groups if improved products are to achieve their deserved acceptance.

Results of some of the work conducted in the development of the new cross-graded oil are described below.

I. Reduced Knock, Preignition and Spark Plug Fouling

A primary and essential objective was to help ameliorate the harmful effects of combustion-chamber deposits on octane number requirement, preignition and spark plug fouling. This was a logical field of activity for a petroleum laboratory with its special skills in oil and fuel processing and composition and in additive compounding. In addition, the authors' laboratories had been engaged in a large-scale and sustained attack on the problem of combustion-chamber deposits. A sobering indication of the magnitude of the necessary effort was apparent from

TABLE 1
Road Octane Number Requirement Increase (ONRI)

Car Make[2]	Clean ONR		Average[1] Stabilized Requirements				
			Commercial[3] Fuel-Lube		Experimental[4] Fuel-Lube		ONRI Difference Due to Fuel-Lube Combination
	Average	Range	ONR	ONRI	ONR	ONRI	
1	84	81—86½	88½	4½	87	3	1½
2	73	68—80½	82	9	77½	4½	4½
3	75½	72—81½	87½	12	83	7½	4½

[1] Each fuel-lube combination was run in 30 cars (10 of each make).
[2] Car make code as designated by engine type given in Appendix A.
[3] Commercial premium gasoline (3ml. tel per gallon) and SAE 20 High VI paraffinic o (MIL-O-2104).
[4] Unleaded alkylate and SAE 20 naphthenic distillate oil (no additives).

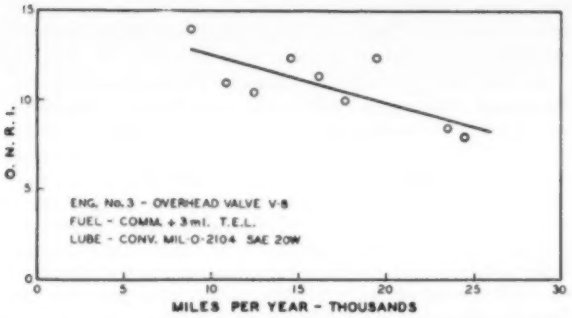


Figure 1. How octane number requirement increases with lower yearly mileage.

engine octane number requirement data such as those shown in Table 1. In addition to the difference in average clean requirement, the data show a change in octane number requirement increase (ONRI) from 4½ numbers for Car 1 to 12 numbers for Car 3. However, these data also have a very hopeful side in showing that two different gasoline-oil combinations can differ by from 1½ to 4½ numbers in ONRI. The necessary scale of work was also indicated by data such as those illustrated in Figure 1 where ONRI is plotted against miles per year. Cars with the lower yearly mileages had the higher ONRI demonstrating the effect of differences in deposit build-up and the need for extensive road testing as a final proof of performance.

In trying to determine the influence of lubricant factors, an investigation was made of the effects of:

(a) All distillate versus distillate-bright stock blends.
(b) Oil viscosity.

Tables 2 and 3 summarize some of the data from engine tests comprehending these variables.

Table 2 demonstrates a considerable increase in ONRI with increasing bright stock content and viscosity. The data under the heading of "Carbon-Lead Salt Ratio" are derived from a special test which has been found to be a useful research tool. These data indicate that increasing percentages of bright stock lead to higher carbon-lead salt ratios in the deposits. It is theorized that the higher proportion of carbonaceous material is responsible for the higher ONRI observed. This effect of bright stock is also

TABLE 2

Influence of Lubricant on Combustion Chamber Deposits and ONRI

LUBRICANT				Lab. Combustion Test Carbon/Lead Salt Ratio	COT Engine Test		Stabilized Road ONRI[2] Average 18 Cars
Code[1]	SAE Grade	Percent Brt. Stk.	Additive Dosage		ONRI	Deposit Wt. Gms.	
A	10W-20	0	Supp. 1	0.7	1½	3	7
B	10W	10	MIL-O-2104	1.5	4½	5	9
C	20W	30	MIL-O-2104	1.7	6½	6	10
D	30	45	MIL-O-2104	2.0	7	7	...

[1] Lubricant code given in Appendix A.
[2] Each oil run to stabilized ONR in 9 cars Make 1, and 9 cars Make 3. Fuel: Commercia + 3 ml. tel.

TABLE 3

Influence of Mineral Oil Viscosity and Volatility on Combustion Chamber Deposits and ONRI

LUBRICANT					Lab. Combustion Test Carbon/Lead Salt Ratio	COT Engine Tests[1]	
SAE Grade	Viscosity SUS @ 210° F.	VI	Percent Bright Stock	90% Dist. Pt. °F.		ONRI	Deposit Wt. Gms.
10W	44.5	109	0	870	.7	0	3
30	62.5	95	0	970	.9	1	3
30	62	98	45	1150	2.3	7	5

[1] Fuel: Commercial + 3 ml. tel.

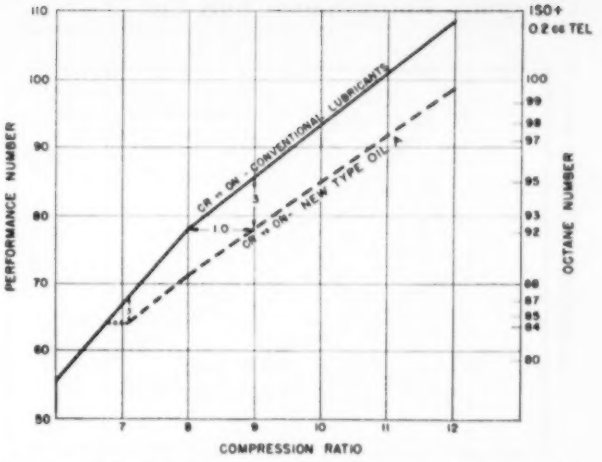


Figure 2. How compression ratio affects octanes with conventional and new type motor oils.

shown in Table 3, in which straight mineral oils are compared. The SAE 10W and SAE 30 grade distillates show 0 and 1 ONRI, respectively, while the SAE 30 blend of distillate and bright stock gives an ONRI of 7. Referring back to Table 2, it should be noted that both laboratory and road data show similar trends.

Because the second and third major objectives of reduced wear and increased cleanliness presupposed higher additive concentrations, the influence of additive concentration on ONRI was also studied. Some limited data are shown in Table 4.

These data indicate no significant effect of detergent concentration on ONRI when using commercial gasoline containing 3 ml tel per gal. With unleaded alkylate, the non-detergent oil gave a much lower ONRI than the Series 2 oil. However, with current commercial fuels and with the detergents investigated by the authors' laboratories, differences in additive concentration did not affect ONRI. Whether this is true in all cases is unknown since results may differ depending on the particular base stocks, additives, engines, fuels and test conditions used.

With this type of background information and with our four major quality objectives in mind, an oil formulation comprising a blend of selected distillate oils plus a combination of VI improvers and new detergent-inhibitor combination was designed. Because of its commercial significance to both the automotive and petroleum industries, some of the data on this product, designated as Oil A, are discussed in the following sections.

Table 5 illustrates the effect on ONRI of the new type of formulation in comparison with more conventional

TABLE 4

Influence of Additives on ONRI

LUBRICANT			Octane Number Requirement Increase		
Code	SAE Grade	Additive Level	COT Engine[1]	17.6 Engine[1]	Multi-Cylinder[2] Engine
A Base	10W-20	None	1	...	...
A	10W-20	Supp. 1	1½	...	...
D Base	30	None	7	12	4
D	30	MIL-O-2104	7	...	...
D (S-2)	30	Supp. 2	...	11½	12

[1] Fuel—Commercial + 3 ml. tel.
[2] Fuel—Unleaded alkylate.

Cross-Graded Motor Oils

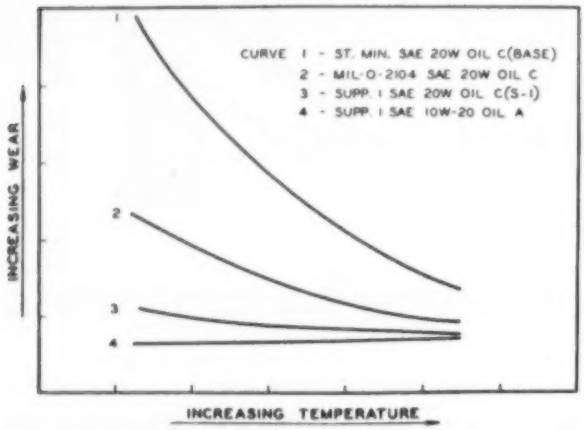

CURVE 1 - ST. MIN. SAE 20W OIL C(BASE)
2 - MIL-O-2104 SAE 20W OIL C
3 - SUPP. 1 SAE 20W OIL C(S-1)
4 - SUPP. 1 SAE 10W-20 OIL A
INCREASING WEAR
INCREASING TEMPERATURE

Figure 3. How motor oils affect engine wear (by radioactive tests).

products. In each case, the new cross-graded product shows a consistent and relatively large gain in reduced ONRI over the more conventional SAE 10W and SAE 20W lubricants, the average advantage being more than 3 octane numbers. In general, Oil A shows a small advantage over SAE 5W-20 Oil E.

The new Oil A represents a major gain in reduced ONRI, which at one time was though impossible to accomplish through lubricating oil. Considerable room for improvement still remains and will continue to be the target of major effort.

All of the previous comparisons of ONRI were obtained starting with engines having clean combustion chambers. Of more immediate importance, although not of greater long-range consequence, is the effect of the change to the new type oil in a "carboned" engine. Information has been obtained on this phase as shown in Table 6.

In each case the oil was changed without any reconditioning of the engine. While the data are not extensive, the trend is consistent and significant in showing a reduction in ONR following the change to Oil A. The average reduction in ONR is approximately three numbers, while the largest gain is 9 octane numbers. The mileages shown are not those required to effect the change but are the mileages at which the cars could be tested conveniently. It should be noted that in some cases substantial decreases in ONR occurred in relatively short mileages after the change to Oil A.

To an increasing extent, the new higher compression ratio engines are showing serious indication of being preignition-limited, rather than knock-limited. Compared to knock, which responds to spark setting, the control or elimination of preignition due to deposits is much less within the power of the engine designer. In addition, preignition is more objectionable and can be more destructive than knock. The data in Table 7 and 8 were obtained in 4 different engines, under different test conditions, and indicate the effect of a major change in oil formulation in alleviating preignition tendencies.

The laboratory test data in Table 7 show that, compared with conventional type SAE 20W oils, Oil A gave a much lower preignition requirement (Expressed as Res. O. N.) in one engine, a great reduction in the incidence of preignition in another, and complete elimination of wild ping in a third. Differences in oil performance are also indicated in the road test data in Table 8, the new type oil showing an advantage in several forms of uncontrolled combustion, including reduced knock as shown by lower ONR, fewer wild pings and no after-running. Experience, based on laboratory and field data, has been that the new type Oil A has a more rapid and larger effect on preignition than on knock.

TABLE 5
Effect of Lubricant on Stabilized ONRI in Different Engines Laboratory and Road Comparison

LUBRICANTS			LABORATORY ONRI		ROAD ONRI			
Code	SAE Grade	Additives	COT	Engine No. 5	9 Cars[1] Make 1	9 Cars[1] Make 3	21 Cars[2] Make 4	5 Cars[2] Make 5
A	10W-20	Supp. 1	1½	5½	4	10	3½	5
E	5W-20	MIL-O-2104	4	....	3½	11	4	....
B	10W	MIL-O-2104	4½	....	5½	12½	....	....
C	20W	MIL-O-2104	6½	10½	6½	13½	6	8½

[1] Each oil run to stabilized ONRI in each of the nine cars.
[2] Each oil run to stabilized ONRI in seven cars.
[3] Oil A run to stabilized ONRI in two cars, oil C in three cars.

TABLE 6
Combustion Chamber Deposits and ONRI Effect of Oil Change in "Carboned" Engine

CAR		Operation on Conv. SAE 20 Oil		ONR After Change-over to Cross-grade 10W-20 Oil A		Change in ONR Due to Oil Change
Year	Make	Miles	Stabilized ONR	Miles Operation on Oil A	ONR	
1949	1	51,107	95½	5,944	92½	—3
1950	2	7,830	87½	5,426	87	—½
1950	2	12,390	90½	4,342	86	—4½
1949	3	15,928	91½	3,409	86½	—5
1951	3	5,309	92	1,332	87	—5
1951	3	4,052	91	4,861	89½	—1½
1952	3	7,701	88	1,032	86½	—1½
1953	4	7,854	92½	2,734	91	—1½
1953	4	8,820	92	4,671	91½	—½
1953	4	6,269	90	3,253	89½	—½
1953	4	10,258	87	2,546	87	0
1952	5	18,214	97	6,830	88	—9
1951	7	32,586	93	5,499	89	—4

Compression Ratio vs. Octane Number Requirement—The immediate and long range significance to fuel manufacturers and engine builders of the three octane number reduction in requirement can be deduced from Figure 2. The solid line shows the relationship between CR and ONR with conventional lubricants. Thus, an engine of 8:1 CR will require 92 Research ON gasoline while a 10:1 CR engine will require 98 ON. The dashed line shows the effect of the new type oil in reducing the fuel quality required at a given CR or, conversely, in permitting a higher CR for a given fuel quality. Thus, whereas the CR with conventional lubricants is limited to 8:1 with a 92 ON fuel, the 3 ON contributed by the new oil permits a compression ratio of 9:1 without change in fuel quality. In existing engines, a lower quality fuel will give knock-free performance at a given CR through the use of the new oil.

From the long-range point of view, the reduction in ONR effected by the lubricant means a corresponding reduction in the ultimate level of fuel quality, with substantial savings in capital outlays for refineries and other equipment. From the standpoint of the car manufacturer, it is estimated that the three ON contributed by the new oil is equivalent to four years in time in considering the normal rate of advance of CR. If the new type oils gain sufficient acceptance, engine builders should be able to think now in terms of CR and designs which could not have been considered for production until 1958 if improvement in fuel quality were to remain the sole controlling factor. The over-all effect will be engines of much higher CR with better fuel economy or performance (or

possibly both) for a given octane number or fuel cost, with resultant gains in cheaper or better transportation.

II. Reduced Mechanical and Corrosive Wear

Mechanical Wear—Smaller parts, higher loads, and much more severe lubricating conditions have resulted in a greater number of parts such as hydraulic valve lifters and cams, operating under boundary lubrication conditions. The boundary lubrication problem is complex, and not much is known about the mechanisms by which metal failure occurs, because of inability to reduce the reactions to fundamental parameters of temperature, pressure, time, etc. For this reason, most of the research has involved an empirical, rather than a fundamental, approach. In addition to the use of bench test machines originally developed, in most cases, to measure the extreme pressure properties of gear lubricants, a number of engine tests have been devised empirically to evaluate one or more of the factors contributing to this problem. Some of these engine tests and their results are described in recent papers by Mougey,[1] Bidwell and Vermaire,[2] Ambrose and Taylor,[3] and Havely, Phalen and Bunnell.[4] The conflicting nature of these data and the inability to explain or predict the difference in performance illustrate the obscure and complicated phenomena involved. While the present paper cannot shed much light on the mechanisms involved, data on valve lifter wear in two modern overhead valve V-8 engines are shown in Table 9.

While published data indicate that viscosity has a measurable effect on wear and scuffing under these boundary lubrication conditions, it appears to be a relatively small factor which can be far outweighed by the influence of selected additives. Comparison in Table 9 of the performance of different oil-additive combinations in the two engines indicates that a lubricant which gives good protection in one engine is not necessarily satisfactory in another and that the order of merit of a series of lubricants can vary from engine to engine, confirming the observations of other laboratories. Oil A appears to have the ability to adequately protect both engines under these boundary lubrication conditions.

In view of the difference in behavior of different engines with a common series of lubricants, it would be too much to expect that any given anti-wear or anti-scuff bench test developed for another purpose would predict performance in any specific engine. As an example, the results on the Timken machine illustrate this weakness. Oil A-1 with the highest rating in the Timken machine gives the poorest results in both Engines 6 and 9, while Oils A and C, with relatively low Timken passing loads, are satisfactory in both engines.

TABLE 7
Influence of Lubricant on Preignition
Laboratory Engine Tests

LUBRICANT		Multi-Cylinder Engine 5—Stabilized Pre-Ignition Req't. (Res. O. N.)	Multi-Cylinder Engine 6—Percent Accelerations Giving Wild Ping	Modified CFR Engine—Pre-Ignition Counts per Hour
Code	Type			
A	Cross grade SAE 10W-20	91½	0	33
	Conv. Type Comm. SAE 20 Oils	99	26	170

TABLE 8
Influence of Lubricant on Preignition and Detonation on the Road

LUBRICANT		ENGINE 5			ENGINE 8
Code	Type	Stabilized Knock Req't. (Res. O. N.)	Wild Pings Average Per One[1] Acceleration	After Running (Switch Off)[1] Per Accelerations	Stabilized Pre-Ignition Req't. (Res. O. N.)
A	Cross-Grade SAE 10W-20	88½	0.7	0 per 11	92
	Conv. Type Comm. SAE 20 Oils	92	3.9	3 per 8	99

[1] Wild Ping and after running tests were made with fuels having octane numbers higher than those shown in column headed "Stabilized Knock Req't., (Res. O. N.)"

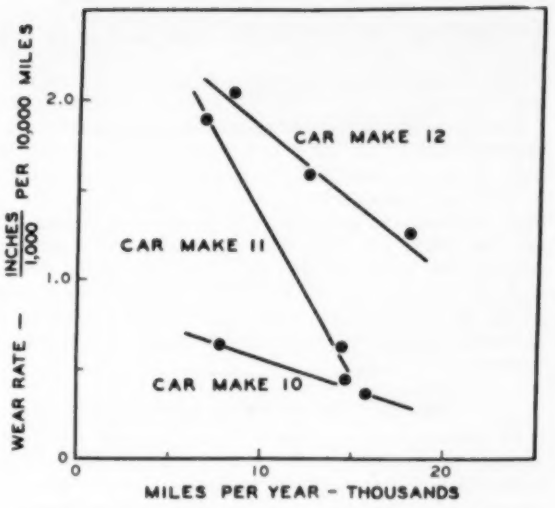


Figure 4. How yearly car mileage affects engine wear.

Corrosive Wear—Increased traffic density and greater use of cars for short trips produce conditions which are more favorable to corrosive attack in our higher horsepower engines. A 1951 survey[5] of car use found that 38 percent of all trips were for less than three miles one way and 63 percent for less than six miles one way. These short trips do not permit reaching high enough jacket temperatures to prevent condensation of corrosive combustion products on the ring and cylinder surfaces, and thus wear is accelerated.

For studies of corrosive wear, CFR gasoline and diesel engines equipped with radioactive top rings have been employed. Wear data over a range of temperatures on four oils differing in viscosity characteristics and additive level are shown in Figure 3. It will be noted that, with conventional oils, wear increases appreciably with decreasing temperature and that at the lower temperatures there is a large difference in the wear protection afforded by a straight mineral oil and by a MIL-O-2104 oil of conventional base stock formulation. Increasing the additive dosage of the latter oil to supplemental List 1 level shows a further decrease in the wear rate. Comparison of Curves 3 and 4 indicates that cross-graded Oil A, with its

TABLE 9
Mechanical Wear Tests

LUBRICANT			HYDRAULIC VALVE LIFTER TESTS		Timken OK Load, Lbs
Designation	SAE Grade	Additives	Engine 6	Engine 9	
A	10W-20	Supp. 1	Good	Satisfactory	10
A Base[1]	10W-20	None	Good	Poor	3
A-1[2]	10W-20	Supp. 1	Poor	Poor	35
C	20W	MIL-O-2104	Good	Satisfactory	6
F	20W	MIL-O-2104	Good	Poor	6

[1] Base Stock-VI improver blend for Oil A.
[2] Oil A with different E. P. agent.

Cross-Graded Motor Oils

lower viscosity at low temperatures, gives lower wear than the conventional SAE 20W oil of like additive content.

Field performance data are believed to support the temperature effects on wear shown in the laboratory. The field results on three different car makes plotted in Figure 4, show an inverse relationship between engine wear and total miles driven per year. The greater the annual mileage, the lower the wear. This is to be expected since, in general, the lower mileage car would usually be the car with the higher proportion of short trips and lower jacket temperatures. The same effect of increased wear with the increased number of starts for the same mileage was reported by Pocock.[6]

III. Increased Engine Cleanliness

In short-trip driving, which constitutes such a large percentage of all trips, the lower temperatures and low load factor of higher horsepower engines are productive of deposits arising from rich-mixture operation and incomplete combustion of the fuel. On the other hand, the closer clearances of these engines demand greater protection against deposits of varnish and sludge-forming materials. The solution to this engine protection problem demands additives which are more effective in preventing the formation, agglomeration and deposition of such harmful products. Because the principal application of these new oils is in gasoline engines, an extensive program involving cleanliness evaluations in a variety of gasoline engine tests was added to the usual Caterpillar L-1 and Chevrolet FL-2 type tests of detergency. One such cyclic test conducted under special operating conditions of admittedly high severity has demonstrated in the past that there is much room for improvement in the capacity of engine oils to handle fuel-formed deposits. An example of this is shown in Table 10 where a premium oil G and Oils A-2, C, and E, employing conventional type detergents, all showed a relatively low level of cleanliness protection. As a result of emphasis on gasoline engine performance, a new type additive combination has been developed for this type of service. The effectiveness of this approach is indicated by the improvement in cleanliness shown by the use of this new additive in Oil A.

IV. Low Temperature Starting, Oil Consumption and Fuel Economy

Starting—As the present Symposium demonstrates, the aspect of oil quality which has been receiving the greatest commercial emphasis from industry has been cross-grading, or the increase in viscosity index which permits one oil to span two or more SAE viscosity grades. Thus, products designated as SAE 5W-20 or SAE 10W-30 have been introduced recently by a number of oil companies. At present, it is difficult to formulate a practical 5W-30 oil due to technical limitations and cost considerations. Since commercially available SAE 5W-20 oils appear to suffer from high oil consumption while the SAE 10W-30 oils appear to be deficient in low-temperature properties, the lubricant manufacturer who wishes to market a single cross-graded oil for use in all cars under all conditions in all areas finds himself in a dilemma. One method of resolving this dilemma is to start with the premise that the engine does not recognize SAE numbers and that the selection of the preferred viscosity range should be based on engine performance data and engine requirements. With such information available, it should be possible to arrive at the viscosity range which will best serve the greatest number of cars and operations.

With respect to the low temperature characteristics, the minimum starting temperatures of four commercial oils ranging from a cross-graded SAE 5W-20 to a conventional high VI SAE 20W oil have been derived from the borderline starting curve in the paper by Fleming et al.[7] The data are summarized in Table 11 together with the key viscosity values on the four oils. It will be observed that in a car in good condition, the SAE 20W oil will permit starting at —3 F; the SAE 10W oil at —10 F, and the SAE 5W oil at —23 F. The viscosities and temperatures shown do not provide for the effect of dilution which is always encountered in engines operating at low temperatures and which tends to lower the minimum starting temperature. If it is considered that a minimum starting temperature of —15 to —20 F. will satisfy the requirements of all but a very small percentage of the cars in this country and that these latter cars can be taken care of by SAE 5W oils, then a product intermediate in low temperature characteristics between the SAE 10W oil and the SAE 5W-20 oil will be satisfactory. An oil such as Oil A which permits starting without dilution at —17 F. appears to satisfy this requirement, although its viscosity at 0 F. does not permit it to be classified as an SAE 5W oil.

Oil Consumption—At the other extreme, high oil consumption under high-speed and high-temperature driving conditions in an undesirable characteristic. Oil consumptions is one of the most difficult performance properties to measure with a satisfactory degree of precision because even small changes in engines, operating conditions, and instrument settings can influence the absolute and relative consumption values in comparing a group of oils or engines. In order to obtain a relatively high degree of precision, the special oil consumption equipment described in the paper by Snyder et al[8] has been utilized. This installation makes it possible to switch from one oil to another without shutting down or changing speed or load. An extensive study has been made of the factors affecting oil consumption and the results indicate that variations in individual engines and operating conditions frequently can greatly outweight oil differences.

The two controlling factors affecting differences due to oils are viscosity and volatility. With respect to the volatility factor, it becomes essential to control both the minimum flash point and the over-all distillation curve. This volatility effect is of particular importance with cross-graded oils which tend to use low-viscosity, low-flash dis-

TABLE 10

100 Hour Cyclic Engine Test

LUBRICANT			ENGINE CLEANLINESS		
Designation	SAE Grade	Additives	Piston 10 = Clean	Over-all 100 = Clean	Oil Ring Slot Clogging, Percent
A	10W-20	Supp. 1	5.0	80	5
A-2[1]	10W-20	Supp. 1	3.9	76	15
C	20W	MIL-O-2104	3.3	77	10
E	5W-20	MIL-O-2104	3.0	75	20
G	20W	Anti-Oxidant Only	2.5	72	..

[1] Oil A with different detergent combination.

TABLE 11

Influence of Lubricant Viscosity and VI on Minimum Engine Starting Temperatures

Oil Designation	E	A	B	C
SAE Grade	5W-20	10W-20	10W	20W
Viscosity, SUS:				
0° F.	<4,000	7,000	10,000	25,000
210° F.	50	55	45	54
Viscosity Index	150	140	110	105
Minimum Starting Temp., °F.	—23	—17	—10	— 3

tillate oils. This is illustrated by the difficulty encountered in eliminating the more volatile and higher flash components with oils meeting SAE 5W-20 specificiations. In Hamer et al[9] reported a VI improved oil showed lower consumption in long mileage road tests than a bright stock blend, both oils having the same SUS viscosity at 210 F and employing the same low-viscosity base stock.

In our program, an extensive test, employing 201 passenger cars and light trucks and more than one million miles of service testing, has been conducted to investigate the oil consumption performance of five oils varying from SAE 5W-20 to SAE 30 viscosities. Results of some of these tests are shown in bar chart form in Figure 5. It should be noted that Oil A (cross-graded SAE 10W-20) is equivalent or somewhat superior in consumption to Oil C (conventional SAE 20 of approximately the same SUS viscosity at 210 F as Oil A) in each of the comparisons. In the one group of vehicles in which Oil A was compared with Oil E (SAE 5W-20), Oil A showed a significant advantage in better oil economy.

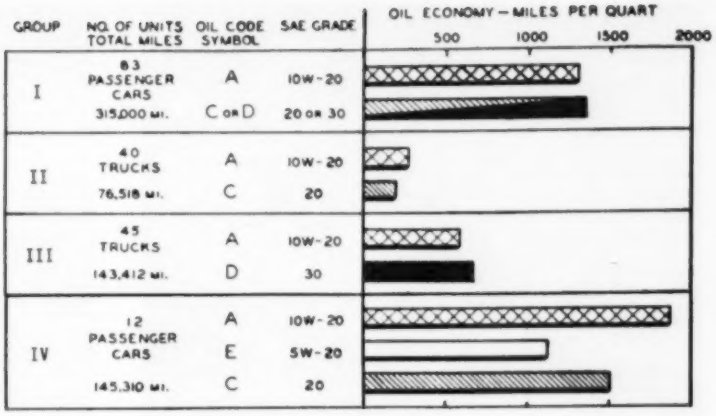


Figure 5—Oil Consumption in Road Vehicles.

Group I —1950-53 cars, individually owned and operated. Variable service. Oil A compared to either C or D in each vehicle.

Group II —1949-53 ½ ton and 1-ton panel trucks. Multi-stop delivery service (20 trucks on each oil).

Group III—1952-53 16,000 G.V.W. trucks. Multi-stop delivery service. 23 on Oil A; 22 on Oil D.

Group IV—1950-52 cars, 6 each of 2 makes. Individually owned and operated. Oils alternated in each car.

Fuel Economy—Improved mileage through the use of the new type oil results from two separate effects. An immediate gain arises from the reduced friction during starting, warm-up and in the normal operating range. This may result in a 5 to 10 percent reduction in fuel consumption in typical cars, with larger gains in some vehicles in the wintertime and in start-stop service throughout the year. A less immediate, but equally important, gain is believed to result from improved combustion chamber and spark-plug conditions. Reduction in combustion-chamber deposits increases volumetric and thermal efficiencies while reduction in spark-plug fouling improves ignition and combustion, with significant benefits in reduced fuel waste. The total gain in fuel economy can be very large in individual cases, as has been demonstrated by service experience with the new product.

The selection of the viscosity range of any oil, conventional or cross-graded, is a matter for each company's individual choice, based on technical and commercial considerations. Analysis of the low-temperature starting and oil-consumption data led the company to the conclusion that a viscosity range of approximately 7000 SUS at 0 F. and 55 SUS at 210 F. would cover the requirements of all but a very small part of the cars in this country. As technological "know-how" moves forward, and as it becomes possible to broaden the viscosity range without adverse effects, it is anticipated that a single oil covering the complete range of starting and oil consumption requirements will be practicable. Until that time emphasis likely will be placed on engine requirements rather than SAE numbers in arriving at preferred viscosity range.

This paper was condensed from its original presentation at the annual meeting of the National Petroleum Association, Atlantic City, September 16, 1954. ##

APPENDIX A

Lubricants

Designation	SAE Grade	Viscosity SUS @ 210 F.	VI	Approximate Additive Dosage
A	10W-20	55	140	Supp. 1
B	10W	45	110	MIL-O-2104
C	20W	54	105	MIL-O-2104
D	30	62	95	MIL-O-2104
E	5W-20	50	150	MIL-O-2104
F	20W	55	95	MIL-O-2104
G	20W	54	105	Anti-Oxidant Only

Engines

DESIGNATION	TYPE
1	8 cylinder, in-line, overhead valve
2	6 cylinder, L-head
3	V-8 overhead valve
4	6 cylinder, overhead valve
5	8 cylinder, in-line, L-head
6, 7, 8, and 9	V-8 overhead valve engines of different makes
10	6 cylinder overhead valve
11	V-8 L-head
12	6 cylinder, L-head

ACKNOWLEDGMENT

Obviously, a work of this magnitude required the cooperative effort of a large number of the authors' co-workers. The number who have made substantial contributions is too great to attempt to mention by name. The authors feel, in presenting this paper, that they are only the spokesmen for this group.

We are also deeply indebted to the numerous individuals in the automotive and associated industries who cooperated so willingly in conducting special engine tests, an important part of this program.

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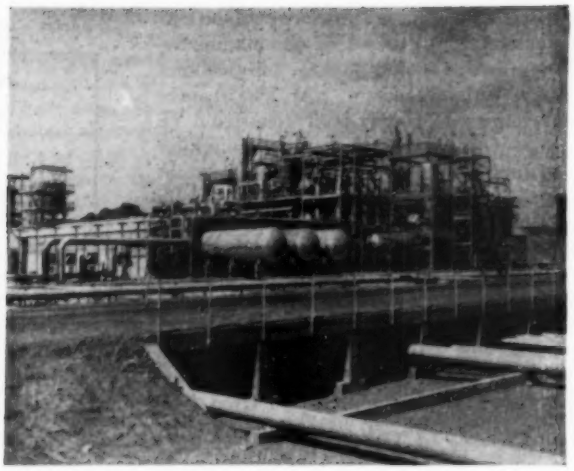
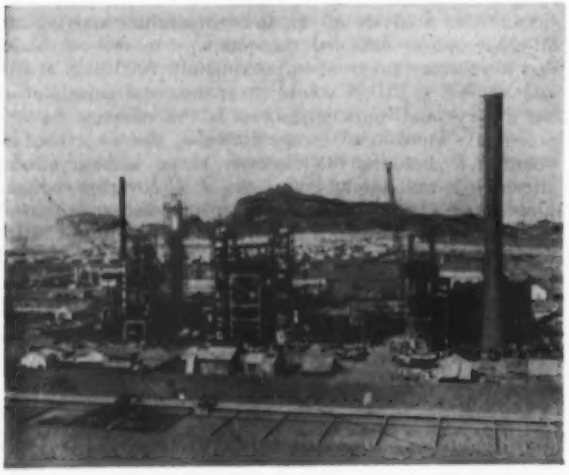
Cross-Graded Motor Oils

1. Crude Unit: 60,000-bpd tower erected in seven weeks by using three prefabricated sections

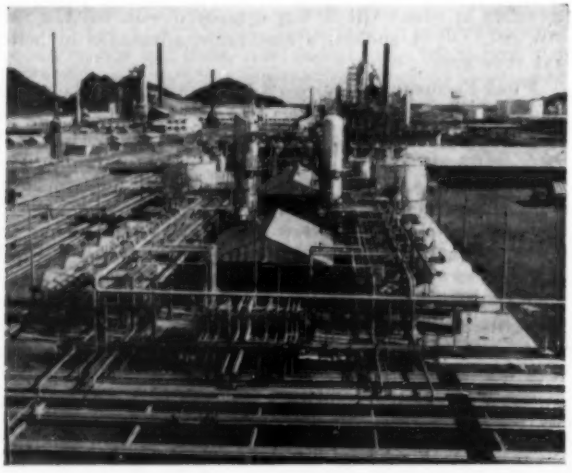


2. SO_2 Extraction Unit: 8000-bpd unit removes from raw kerosine aromatics which are later blended into power kerosine

Tour Through Anglo-Iranian's . . .

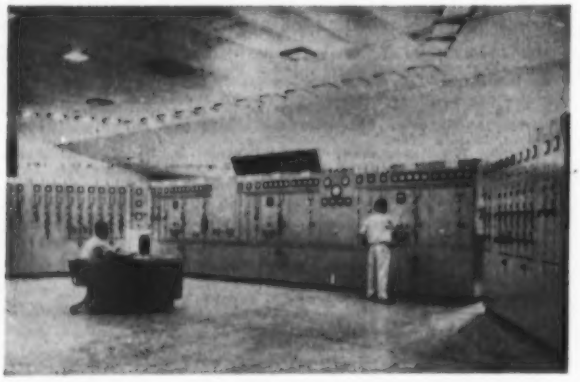


3. Platformer Unit: 12,000-bpd unit reforms and sweetens gasoline

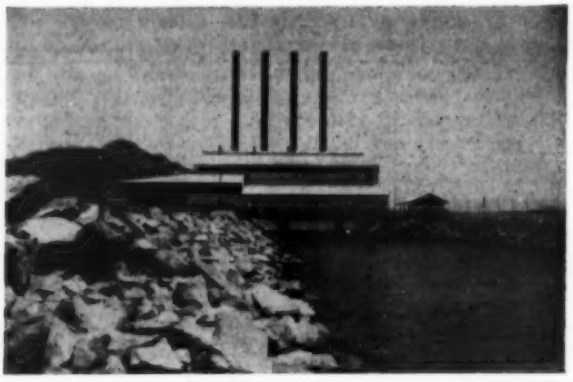


4. Solutizer/Copper Chloride Treating Plant: Sweetens gasoline.

. . . Little Aden Refinery



5. Power house control room: Power for the 120,000-bpd refinery and the Little Aden area



6. Salt water intake: Cooling water for the refinery and power station

Field Welding Heavy-Wall Vessels

Here are previously unpublished tips on how to obtain sound welds in heavy plate under field conditions.

F. A. Upson,
Standard Oil Company (Indiana)
Whiting

WITHIN THE PAST several years there have been a number of jobs at the author's company involving the field welding of heavy-wall pressure vessels. These have included the field erection of about a dozen new vessels ranging in diameter from 8 to 60 feet and in thickness from 1 to $2\frac{5}{16}$ inches. Field replacement of shell plates, field installation of nozzles, and field installation of flush inlaid patches also have been successfully accomplished variously on about two dozen vessels ranging in diameter from 4 to 15 feet and in thickness from about 2 to about 5 inches. Plate specifications were ASTM A-285 Grade C (or equivalent), A-201 Grade A, and A-212 Grades A and B. Each of these specifications was encountered throughout a major portion of the thickness range mentioned; in particular, the A-212 material (both grades) included thicknesses up to $2\frac{3}{4}$ inches.

In general, it has been found that the problems encountered in the field welding of heavy-wall vessels are not essentially different in type from these encountered in the shop welding of such vessels. The major differences are to be found in the reduced facilities for convenience in performing the work, as a result of field conditions, which result in a change in the relative importance of many of the factors. For instance, in field work all welding usually must be done in a fixed position, provision must be made for adequate protection against the weather, extensive rigging is often required for radiography, and repair of defective welds may be much more difficult. Also, since stress-relieving involves insulating the vessel and oftentimes rather elaborate facilities for providing the heat and distributing it to the various parts of the vessel, the cost of field stress-relief is much higher than the cost of the usual shop stress-relief.

The following paragraphs constitute a brief exposition of some of the difficulties which have been encountered in this class of work, a review of the precautionary measures which have been found justified, and a description of remedial actions which occasionally have been required.

Fit-Up and Other Preliminaries

Because of the difficulty of handling heavy plate in the field, as compared to handling it in the shop, there frequently appears to be a tendency to use insufficient care in effecting a good fit-up for field fabrication. Whereas the importance of good fit-up increases with plate thickness irrespective of where the work is done, the need for good fit-up in field fabrication is even more important than for shop work because, among other things, all welding must be done in a fixed position. Trial fit-up in the shop prior to shipment is greatly to be desired.

It is necessary that the fit-up, once accomplished, be held against shifting by means of suitable heavy finger bars, strongbacks, braces, etc., at least until a very substantial amount of weld metal has been deposited. The fit-up should be accomplished whenever possible such that jacks, wedges, and the like, are not required to maintain the position of the plates even though their use may be needed to achieve the proper positions in the first place. Local heating and/or sledging never should be permitted for achieving the fit-up.

When the root gap in a welding groove cannot otherwise be rendered uniformly of the desired size, the adjoining edges of the plates should be built up where necessary by welding and then dressed by chipping and/or grinding to provide the desired gap. Variations exceeding $\frac{1}{16}$-inch from the nominal dimension are likely to cause trouble. The proper width of land at the center of a double bevel is sometimes subject to argument but a nominal width of about $\frac{1}{16}$-inch, which seems to be a reasonable practical minimum, has much in its favor. Less may result in an uneven feather edge, while more will often increase the amount of backchipping required. These suggested limits are subject to considerable variation if a back-up bar is used, but this is hardly practicable unless flame or arc gouging is to be used instead of chipping for preparation of the back-groove.

If plate edges can be machined, then a double U-type groove is to be desired, especially in thicknesses over $1\frac{1}{2}$ inches, so as to minimize weld metal; otherwise a double V-type groove should be provided. In either case, the groove should be no wider than necessary to permit adequate access to its root but in no event should such access be restricted. For a double V-type groove, a 60° included angle seems to be a sound compromise between these two points of view; i.e., 45° is definitely too narrow while 75° is wider than necessary. Whereas an unsymmetrical bevel has the theoretical advantage of equalizing distortion resulting from weld shrinkage, this advantage is often largely lost in practice because of the impossibility of predicting accurately the amount of back-chipping to be required.

Because of the difficulty of making repairs after the parts to be joined have been erected in position, all welding edges, after beveling, should be inspected to assure the absence of flakes, laminations, and other discontinuities which might interfere with the production of sound welds. All plate surface defects also should be repaired prior to erection. Flame-cutting and flame-gouging in achieving good fit-up are entirely satisfactory and often result in considerable economies but it is necessary that the work be preheated in the area to be cut or gouged in order to minimize what are known as "flame-cutting cracks" along the burned surface.

After the fit-up has been completed, the preheat should be applied in a manner to avoid nonuniform expansion which would affect the fit-up adversely. Usually this means that all edges of each sheet involved must be brought to essentially the same temperature even though welding on all edges at once rarely can be considered.

Use of electric strip heaters is usually the most convenient and satisfactory means of providing the preheat but in some cases propane or fuel-gas burners can be used provided that they produce a clean, soft flame and

are satisfactorily designed and located so as to avoid excessive localization of the heat. Acetylene torches are not satisfactory. Where the only welding involved is on the outside of the vessel and where the strength of the vessel is adequate, as might be the case in the repair of an external nozzle weld in an existing vessel, the introduction of 100-psi steam inside the vessel is an excellent means of providing preheat.

For plates more than 2 inches, a preheat temperature of about 400 F. is desirable, particularly on high-tensile material such as ASTM A-212, although 300 F. (minimum) often has been adequate. For ordinary mild-steel material such as ASTM A-285, Grade C, in lesser thicknesses but more than about 1 inch, a 200 F. preheat is very desirable but apparently not essential. In no case should primary strength welds on a thick vessel be attemped when the parent metal is at essentially less than normal "room temperature."

Adequate provision must be made to protect the work from the weather. This includes facilities to keep wind, rain, and snow away from the welding area as well as to protect the work (and the welders) from exposure to wind or low atmospheric temperatures. In some cases tarpaulins can be suitably hung to accomplish these ends while in other cases temporary plywood enclosures are needed.

Welding Procedure

One of the most important features of any sound procedure for the field welding of heavy-wall vessels is to have the work arranged so that, when welding has once commenced on any seam, it is continued without interruption until that seam has been completed. If this is impossible, then arrangements should be made at least to permit maintenance of the preheat without interruption until the welding has been completed. In no case should the welding be interrupted until a substantial proportion of the total weld thickness has been completed.

Interpass Cleaning—Meticulously careful cleaning of each pass of weld metal prior to deposition of subsequent passes is extremely important. This interpass cleaning should include the conscientious removal of every crack, undercut, pinhole, etc., as well as the removal of all slag; accordingly, it is in some respects more of a "dressing" operation. Chipping is preferred for this purpose rather than flame-gouging, and an experienced operator with a sharp gouge is essential in order to avoid rolling the metal againt the side wall of the groove or smearing metal over a pocket or undercut.

Peening—Heavy peening should be expressly prohibited in most cases because of the fact that its benefits from the standpoint of minimizing cracking are at best questionable, except perhaps under carefully controlled conditions which seldom exist in the field, and because of the further fact that it can result in slag, undercutting, pinholes, etc., being masked.

Welding Rods—The type of rod used will have a very great influence on the interpass cleaning operation. The slag from some types of rods is much more readily removed than that from others and a rod with a "digging" arc characteristic will often result in a very troublesome amount of undercutting (more so in some positions than others) at the edges of each bead, although the extent to which this occurs is, in a measure, under the control of the individual welding operator.

The size of rod to be used will depend on a number of different factors which vary from one job to another. Only rarely should anything larger than $\frac{1}{8}$-inch rod be used for passes near the root. The thickness of each bead naturally will depend in part on the size rod used but in each case the bead thickness should be moderate. If it is too thin, fusion may be impaired; if it is too thick, transverse cracking is invited. A maximum thickness equal to the rod size but not over $\frac{3}{16}$-inch might be a reasonable rule of thumb in most cases.

The use of a low-hydrogen type rod is distinctly worth while except that some of them, at least, apparently are not satisfactory for work in the overhead position. In order to avoid excessive porosity when using them, it is necessary that very close control be exercised over the welding operators (and the setting of the machines) to make certain that the operators are extremely careful in the manner in which they hold the arc and manipulate the rod. Stringer passes are the rule irrespective of position. A cellulosic type of electrode (e.g., E-6010) should be employed for sealing the root of the weld initially so that the base of the arc will not be exposed when the low-hydrogen rod is used.

Low-hydrogen rods are particularly susceptible to damage from the absorption of atmospheric moisture. Accordingly, the importance of proper storage can hardly be over-emphasized. This matter is greatly simplified if the rods are purchased in small waxed cartons hermetically sealed at the factory. The welders should not be given more than a few hours' supply at a time.

"Backstepping"—It is believed that the advantages of a "backstepping" sequence for depositing weld metal has occasionally been overstated, or, at least, misunderstood. Other things being equal, of course, backstepping will certainly minimize weld shrinkage and cracking but, unfortunately, it is often difficult to hold the "other things" equal. For example, if the successive steps are to be adequately "tied in" to each other or, as is often the case, are to overlap appreciably, adequate interpass cleaning at the "tie-ins" or the overlaps may become almost impossible. A sharp undercut thus covered over presents a fine opportunity for subsequent cracking and in any event probably will hold a nice slag stringer.

Preparation of Back-Groove—For preparation of the back-groove, arc-groove, arc-gouging is usually the first choice assuming a skillful operator is available. It is even faster than flame-gouging and has less tendency to propagate cracks. If a skillful arc-gouge operator is not available, then recourse to chipping is recommended where the degree of constraint is unusually high or to flame-gouging where excessive constraint is not a problem. An arc-gouged surface, if clean, is satisfactory for welding without dressing or other preparation but it is very important that all debris resulting therefrom be removed carefully. This material is exceedingly high in carbon content and may cause hard spots if puddled into a weld. Irrespective of how the back-groove is prepared, it should be inspected to demonstrate the adequacy of the preparation before backwelding is started.

It is not necessary to complete the welding on one side of a double bevel before preparing the groove on the other side for backwelding. After the first side has been perhaps $\frac{1}{3}$ to $\frac{1}{2}$ filled, the groove on the opposite side can be backchipped, flame-gouged or arc-gouged for the removal of the back-up bar, if used, and of all unsound root material. After this operation has been completed, and examination of the groove has demonstrated the complete removal of any back-up bar and of all cracked or otherwise unsound material, welding may progress on both sides of the joint at the same time if desired.

Butt-Welded Patches—One of the most notoriously difficult weldments to complete successfully is the installation of full thickness butt-welded (flush-type) patches in heavy-wall pressure vessels. In such cases it has been found that variations from conventional practice as to sequence of operations are very worth while. In fact, routine success has been experienced

in the installation of about 50 such patches in vessel walls having nominal thicknesses of 3 and 5 inches. The sequence of operations employed is as follows:

(1) Following careful fit-up, and working from the outside without preheat, deposit from one to three stringer passes in the root with a cellulosic rod. This part of the weld may well crack, but, as will be shown presently, this is of no consequence.

(2) Apply and maintain a preheat of 300 F. minimum using gas rings mounted outside the vessel.

(3) Working from the inside without any root preparation, complete the inside weld using low-hydrogen rod.

(4) Close the vessel and admit steam, gradually increasing the amount while controlling the gas rings downward so as to prevent any sudden change in preheat. When the preheat is being maintained by steam alone, dismantle the gas rings.

(5) Backchip or backgouge from the outside to remove the original root weld made with cellulosic rod as well as any underlying unsoundness. Check by means of magnetic particle examination. Inspect for flakes, laminations, etc.

(6) Complete the weld from the outside using low-hydrogen rod.

(7) Gradually reduce the preheat temperature to ambient by controlling the steam.

In following this procedure, two general precautions should be emphasized: (1) Once welding under preheat (Step 3) has commenced, the preheat should be maintained until all welding is complete (i.e., through Step 6), and (2) Step 3, once commenced, should continue without interruption around the clock to completion.

If electric strip heaters are used instead of gas rings, then Step 4 is, of course, unnecessary and Steps 5 and 6 can proceed before Step 3 is complete, if so desired, but for a circular patch, the simplicity of a gas ring is advantageous and the reliability and uniformity of steam preheat for the outside half of the weld are unsurpassed.

With respect to Step 1, the choice between one stringer pass as compared to three, for example, is not clear cut. The total depth of backchipping or backgouging in Step 5 may be expected to be about the same in either case. If three passes are used, slightly more weld metal may be sacrificed, but if only one pass is used, the total depth of the outside groove is likely to be increased somewhat with an attendant reduction in accessibility at the root.

Post-Welding Operations

If radiography is required for the job, adequate means for manipulating the X-ray machine must be provided or else a gamma-ray source must be used. The former alternative sometimes involves the use of rather extensive rigging, whereas the latter generally will require much longer exposure times. When working with weld thicknesses in the neighborhood of 3 inches or more, however, the gamma-ray technique ordinarily will be the only choice because the size and weight of high-voltage X-ray machines make them virtually inadmissible for the usual field job.

Qualifications for Welders—When any vessel is fabricated in a shop, the welders are usually men who have been in the fabricator's employ on a more or less regular basis and their capabilities are well known. Field fabrication, on the other hand, often will involve the employment of craftsmen recruited locally at the site with the result that considerably less will be known about them than about shop personnel. Whereas it is true that all vessel welders are customarily required to pass at least the standard AWS operator's qualification tests, or equivalent, it is a well-known fact that many welders capable of passing such tests seem nevertheless unable to produce X-ray quality work with reasonable consistency. Accordingly, it is very important on a field job that radiography follow up the welding as closely as possible so that unsatisfactory welders can be taken off the job before they have laid down more than a minimum amount of defective weld and, further, so that the details of the field-welding procedure may be modified early in the job if found to be necessary.

Repair of Defects—When excavating for a weld defect revealed by radiography, chipping, flame-gouging or arc-gouging may be used. Flame-gouging is from ten to twenty times faster than chipping, even though preheating should be employed. Arc-gouging is even faster, and preheating for it seems unnecessary. In any case, the final excavation, after any necessary dressing, always should be inspected for flakes, laminations, and other discontinuities before rewelding, and it may be very worthwhile to check the excavation by means of radiography prior to rewelding so as to provide greater assurance that the defect actually has been removed. If this is done, the check film should be shot from a different angle than the original so that if the defect remains, it can be located more exactly by triangulation. If proper procedures and due care are exercised prior to and during deposition of the original weld, defects should be virtually nil. There is no reason why on a big job more than 1 percent of the original films should exhibit any objectionable defect as compared with as much as 10 percent or more on many manually welded shop jobs. The total length of objectionable defects has been found on several field jobs to be well under 0.1 percent of the total seam length.

Stress-Relief—Local stress relief can be accomplished electrically by either resistance or induction. In either case, an entire circumferential band should be heated. Considering power requirements, this means is seldom practical except when a single nozzle weld or circumferential weld is involved. In such a case, internal as well as external insulation must be provided and means for careful control of temperature gradients is essential.

Preheating Furnace—Full thermal field stress-relief of an entire heavy-wall vessel can be accomplished best by means of a gas-fired furnace with or without facilities for recirculation of flue gas. The greatest difficulty in obtaining a satisfactory stress-relief is usually in the lack of sufficient facilities to provide an even distribution of heat throughout the vessel. Merely inserting a burner inside the vessel itself is most unsatisfactory in this regard. It is necessary to have the burners in an external furnace piped to the vessel to permit circulation of the hot flue gas through it.

Adjustable aspirators and dampers should be provided in stacks or vents located generally on each manway and major nozzle. Any nozzle not so equipped should be blinded. Sufficient baffling (including distributor ducts and dampers, if necessary) of an appropriate design should be mounted inside the vessel to insure even distribution of the hot flue gas.

Combustion air to the furnace burners must be premixed with the fuel gas to produce a clean flame. Provision must be made for admitting a large amount of excess air to the furnace chamber in order to keep the inlet flue-gas temperature down to a reasonable level. Adequate control of vessel temperatures will otherwise be impossible even if the internal baffling is not functionally destroyed due to warpage. The greater the flow of flue gas through the vessel, the greater will be its turbulence and, consequently, more even vessel temperatures will result.

The outside of the vessel must be insulated heavily with particular attention to nozzles, manways, flanges, reinforcing pads, points of support, and miscellaneous attachments. Ordinarily about four inches of blanket

insulation will be the minimum acceptable. Furthermore, adequate means of preventing wind from blowing across the blankets is required. In this connection, however, care must be taken to be certain that no combustible materials such as tarpaulins or temporary wooden framework can approach the heated parts. A liberal supply of additional insulation (and the craftsmen to apply it) must be readily available should more be required at any location after the stress-relieving operation has commenced. In view of the serious consequences that might result if the insulation (or even part of it) should fall off when the vessel is at or near stress-relieving temperature, it is of paramount importance to be absolutely certain that the insulation is securely installed initially. It is virtually impossible to reapply insulation to an 1100 F. surface and a large amount of time is lost in repeating the stress-relieving operation even if the vessel sustains no damage.

Cooling Cycle—The fact that a large amount of insulation is required in order to permit bringing the vessel up to temperature in a reasonable length of time makes necessary the provision of means for cooling the vessel at a reasonable rate after the required period at the stress relieving temperature. It has been found that, without some particular provision to bring the temperature down, it will fall at not more than 5 or 10 F. per hour. A useful means of increasing the rate of cooling is to inject cool air into the vessel, and this implies the need for an adequate means of control so that the cooling is done uniformly.

Thermocouples—Fairly complete coverage of the vessel with thermocouples is necessary. No detailed rules as to numbers and locations of thermocouples can be given but it has been found that usually a thermocouple should be provided on the reinforcing pad and on the neck of each manway and major nozzle and that representative minor nozzles should be similarly equipped. Furthermore, additional thermocouples should be provided on each head in number dependent upon the vessel diameter, orientation, and head-nozzle locations. Thermocouples should be provided every 8 or 10 feet along the length of the shell; on vertical vessels, one thermocouple should should be located at each end of a diameter in each such space, while in the case of a horizontal vessel, top, bottom, and each side should be thus equipped. In deciding exactly where to locate the thermocouples, the geometry of the individual vessel and its appurtenances, its means of support, and the nature of the internal flue-gas baffles must be studied carefully.

Temperature Record—Thermocouples should be of the welded type, tackwelded to the vessel. Peened thermocouples are often unreliable. Furnace temperature, inlet flue-gas temperature inside the vessel remote from the inlet, and the flue-gas temperatures at representative outlet vents also should be measured. Each thermocouple should be connected to a recorder so that a continuous record is obtained of all temperatures. Two twelve-point recorders are usually sufficient; leads to them should be arranged so that each records points well distributed over the vessel. An instrument man should be readily available at all times should a quick repair become necessary.

Since fluctuations in fuel-gas pressure, air-line pressure, wind direction, wind velocity, etc. have a critical effect on the stress-relieving operation, and since the response of the metal temperatures to these fluctuations and to corrective action is usually sluggish, it is essential that vigilant, detailed, and competent attention to the progress of the operation be maintained uninterruptedly around the clock until completion. The importance of this requirement cannot be overemphasized.

Inspection—After stress-relieving is complete, at least all manway, nozzle, reinforcing pad, and patch-plate welds should be inspected prior to hydrostatic test.

It has been found that each different size and shape of vessel constitutes something of an independent problem and that experience gained on one vessel will not be directly applicable in all details to another vessel of a different size or shape. Nevertheless, experience shows that it is perfectly feasible to raise vessel temperatures uniformly at a rate of 40 to 50 F. per hour to temperatures even in excess of 1200 F., if desired. Uniform cooling rates as high as 50 or even 75 F. per hour also can be obtained. On heating and cooling, the total spread of temperatures over the entire vessel (if vertically mounted) ordinarily can be kept within 100 F. without too much difficulty and the total spread at the stress-relieving temperature usually need not exceed 40 to 50 F. In the case of horizontal vessels, the temperature spreads ordinarily will be about double those for vertical vessels.

Design Considerations

Whereas a number of the points considered in the foregoing are affected more or less directly by various design considerations, there is one not yet mentioned which deserves special emphasis. In heavy-wall vessel construction it has been found that welds of less than 100 percent penetration, or otherwise having unfused roots (such as reinforcing pad fillet welds, for example) are extremely troublesome, not only in the difficulty encountered initially in obtaining a weld free of root cracks, but also from the standpoint of possible cracking or propagation of cracks during service. Accordingly, full-penetration welds should be used wherever feasible in attaching nozzles and other shell appurtenances.

Based upon entirely successful experience in the full-penetration field welding of a number of solid flush inlaid patches in thick (up to 5-inch) vessel shells, it seems evident that a nozzle of the integrally reinforced butt-welding type, with a little care, can be installed more satisfactorily than the conventional integrally reinforced nozzle or the built-up nozzle assembly having a separate reinforcing pad. This recommended construction also has the great advantage of being susceptible to easy radiographic examination.

It is suspected that the objections to butt-welding type nozzles which frequently have been raised may be largely a manifestation of superstition based perhaps upon a lack of actual experience with such details. The successful field installation of solid inlaid patches in thick shells surely indicates that butt-welding type nozzles are entirely practical and the ease with which they can be radiographed is of such major importance that this type of construction should be used wherever possible in the shop as well as in the field.

Conclusion

Many of the foregoing paragraphs describe procedural details and precautions that at first glance might seem unduly conservative or otherwise unjustifiably expensive or time-consuming. It has been found by hard experience, however, that such is actually not the case. Attempts to save time or expense by short-cutting these items are more or less certain to result in the ultimate expenditure of far more than possibly can be saved and probably will produce an inferior job as well. It is believed that the case for care in the field welding of heavy-wall pressure vessels has in no way been overstated.

Original presentation was at the Ninth Annual Petroleum-Mechanical Engineering Conference of the American Society of Mechanical Engineers, Los Angeles, September, 1954. ##

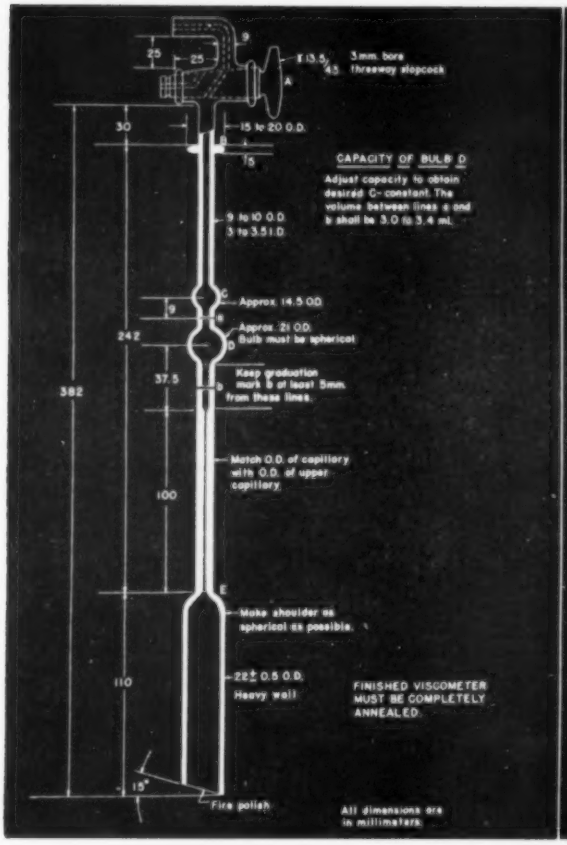


Figure 1. The Atlantic viscometer.

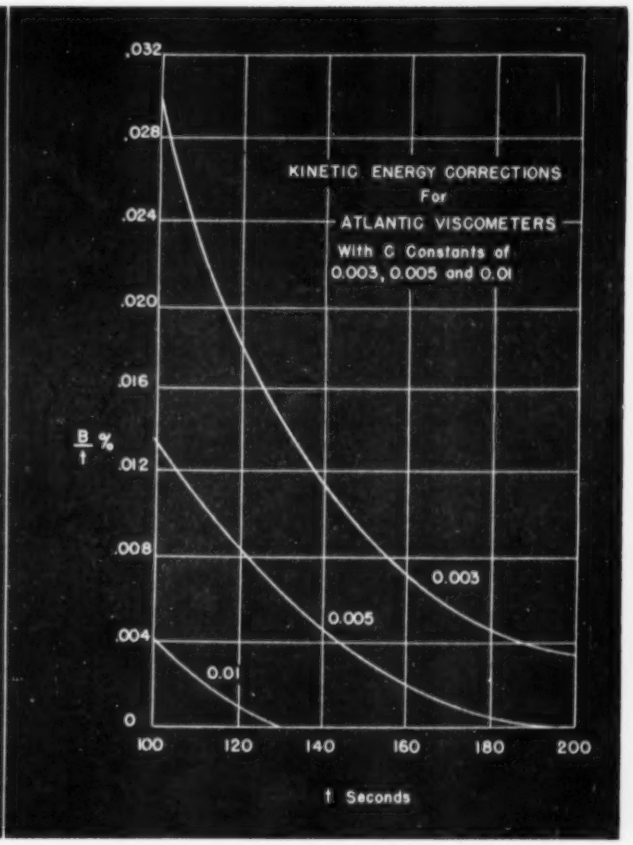


Figure 2. Variations of kinetic energy corrections with efflux time.

New Viscometer Solves Old Problems

The age-old problem of a method of measuring viscosity in fundamental units is solved with an instrument developed by Atlantic.

J. J. Watt and C. E. Headington,
The Atlantic Refining Company,
Philadelphia

THERE HAS recently been an evolution in laboratory methods of measuring viscosity of petroleum products. For many years, the petroleum industry measured viscosity by timing the flow of a fixed volume of liquid through an orifice. Although these methods of comparing and measuring viscosities[1,2] were standardized and considered adequate, they no longer can be considered accurate enough to satisfy modern petroleum refining requirements because of the following limitations:

1. The degree of precision does not satisfy modern refining requirements.

2. The range of viscosity measurements is limited; especially in the lower viscosity ranges.

3. The viscosity measured is in empirical rather than fundamental units.

Changing to a method measuring viscosity in fundamental units, not having the above limitations, has been

unduly slow. The problem of educating refinery and sales personnel in fundamental units of viscosity has been in a large measure responsible for this slow transition.

A great stride was made toward a change to fundamental viscometry when the glass capillary type viscometers made their appearance in the early 1930's. The many forms that capillary viscometers took are indicative of the degree of accuracy sought in routine viscosity measurements. M. R. Cannon and M. R. Fenske[3, 4] modified the Ostwald U tube viscometer so that it might be used as a routine instrument.

L. Ubbelohde, in 1933, presented the suspended level viscometer which was designed to establish an accurate driving head. Three years later he presented a modification intended to eliminate the effect of surface tension by establishing a suspended spherical level.[5, 6]

While a variety of modifications of the glass capillary type viscometer have been designed, none are fully satisfactory from a standpoint of ease of manipulation and ruggedness. All are satisfactory for the research laboratory but none meets all of the requirements for routine testing in plant control or routine laboratories.

The development of the Atlantic Viscometer resulted from the desire for a durable routine capillary type viscometer. The factors considered, in addition to precision, were ease of manipulation and operation, ruggedness in construction and permanent installation to eliminate time consuming handling. Figure 1 illustrates the Atlantic viscometer as developed for The Atlantic Refining Company's Product Control Department laboratories.

The viscometer has been in constant routine service for the last 15 years during its various stages of development. It has proven easy to manipulate, and sturdy enough to reduce breakage to a very low figure. Its precision has been attested by numerous comparisons with oils measured in long capillary viscometers.[7] It has found acceptance by the American Society for Testing Materials and is listed as one of the approved methods in the current ASTM D-2 handbook under Method D 445-53T.

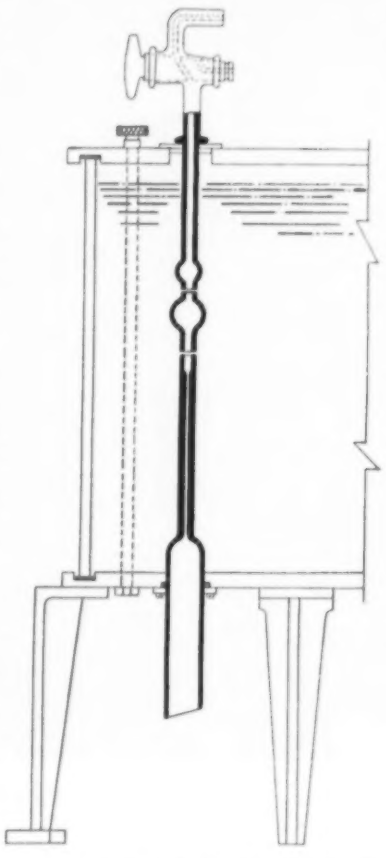


Figure 3. The Atlantic viscometer installed in its bath.

TABLE 1

Constant C	CAPILLARY Diam. mm	CAPILLARY Length mm	VISCOSITY RANGE* Centistokes	VISCOSITY RANGE* Saybolt Universal Seconds
0.003	0.41–0.42	100	0.6 to 3.0	
0.005	0.46–0.48	100	1.0 to 5.0	
0.01	0.55–0.57	100	2.0 to 10	33 to 59
0.03	0.72–0.75	100	6.0 to 30	46 to 140
0.05	0.82–0.85	100	10 to 50	59 to 230
0.1	0.98–1.01	100	20 to 100	98 to 460
0.3	1.29–1.33	100	60 to 300	280 to 1400
0.5	1.46–1.51	100	100 to 500	460 to 2300
1.0	1.74–1.80	100	200 to 1000	920 to 4600
3.0	2.30–2.37	100	600 to 3000	2800 to 14000
5.0	2.60–2.69	100	1000 to 5000	4600 to 23000

* The normal temperature range for the Atlantic viscometer is from the dew point to 210 F. By changing the bath medium and taking the necessary safety precautions, the useful temperature range may be extended to 500 F.

Theoretical Background—Basically, all the glass capillary viscometers now in use are based upon Poiseuille's principle of capillary flow which he formulated in 1846. The fundamental relationship for absolute viscosity in terms of the dimensions of the viscometer is expressed in the equation:[8]

$$\eta = \frac{\pi g p R^4 t}{8 V L}$$

where:

η = viscosity in poises
g = gravitational constant in cm per sec^2
p = pressure in grams per cm^2
R = radius of capillary in cm
t = efflux time in secs
L = length of capillary in cm
V = Volume of efflux bulb in cm^3

In 1860 Hagenbach pointed out that corrections for kinetic energy were required for Poiseuille's equation. Energy is absorbed in overcoming static flow conditions at start of flow and initiating laminar flow of the liquid through the capillary.

The corrected formula is as follows:

$$\eta = \frac{\pi g p R^4 t}{8 V L} - \frac{m \rho V}{8 \pi L t}$$

where m = a factor which varies with Reynolds number and the physical characteristics of the viscometer[9] and ρ = the density of the liquid.

The Poiseuille equation, corrected for kinetic energy, has been adapted for kinematic viscosity as follows:

$$KV = \frac{\eta}{\rho} = \frac{\pi g H R^4 t}{8 V L} - \frac{mV}{8 \pi L t}$$

where H = effective driving head

Since the dimensions of the viscometer are constant the equation can be reduced to:

$$KV = Ct - \frac{B}{t}$$

where:

$$C = \frac{\pi g H R^4 t}{8 V L}$$

$$B = \frac{mV}{8 \pi L}$$

In the design of most glass capillary viscometers B/t is kept small in relation to Ct. Thus, the formula for Kinematic viscosity can be reduced to:

$$KV = Ct$$

TABLE 2

Viscometer	C-CONSTANT 0.003			C-CONSTANT 0.005			C-CONSTANT 0.01			C-CONSTANT 0.03		
Efflux Time (t)	KV_{cs}	Re	B/t %	KV_{cs}	Re	B/t T	KV_{cs}	Re	B/t %	KV_{cs}	Re	B/t %
200	0.60	82	0.003	1.00	43	0	2.00	18	0	6.00	4.6	0
180	0.54	101	0.005	0.90	54	0.001	1.80	23	0	5.40	5.7	0
160	0.48	128	0.007	0.80	68	0.002	1.60	28	0	4.80	7.2	0
140	0.42	167	0.011	0.70	89	0.004	1.40	37	0	4.20	9.4	0
120	0.36	227	0.018	0.60	121	0.008	1.20	51	0.001	3.60	13	0
100	0.30	327	0.030	0.50	174	0.013	1.00	74	0.004	3.00	29	0

NOTE: For the purpose of calculations it is assumed that KV = Ct for low efflux times. The error introduced in this assumption is negligible.

To insure further that B/t is kept small the ASTM method of test for Kinematic Viscosity ASTM D445-53T states that all efflux times (t) shall be in excess of 200 seconds. In some viscometer designs this time limit may be reduced without sacrificing precision.

Design Features—The Atlantic viscometer is of the suspended spherical level type and, therefore, has the design features of that type instrument; namely, no surface tension corrections, and a constant value of viscometer, C-constant over wide ranges of temperature.[6]

The Atlantic viscometer is constructed of heavy walled tubing and precision bored capillary. It may be cleaned, filled and discharged with a minimum of handling. After the viscometer is installed in its bath, no removal is required for cleaning or filling. It remains in the bath continuously. This permanent installation feature has resulted in a phenomenally low breakage record, many viscometers being in continuous use for 15 years.

Table 1 gives the Atlantic viscometer dimensions, C-constants and range of viscosities.

The physical characteristics shown in Figure 1 and given in Table 2 are such that the kinetic energy correction is less than the maximum specified in ASTM D445-53T.

Kinetic Energy Correction—The kinetic energy correction factor "m," from the Poiseuille corrected equation, has been found to vary with Reynolds Number (Re) and the dimensions of the viscometer. Percent B/t therefore, is dependent on Re experienced in operation. Table 2 lists the calculated values of Re and percent B/t for the fine capillary Atlantic viscometers in which the highest Reynolds numbers occur. The "m" factors used for these calculations are taken from J. D. Bell's thesis Table 8.[9] Figure 2 shows the plot of B/t vs t for these viscometers.

$$Re = \frac{V\ 100}{.785\ (D)\ KV}$$

where:

V = efflux volume
D = diameter of capillary
KV = kinematic viscosity in centistocks

It readily can be seen that the kinetic energy corrections may be neglected at ordinary efflux times.

Operating Procedure—The procedure for operating the Atlantic viscometer is as follows:

(a) Mount the viscometer vertically in the Atlantic Viscometer constant temperature bath, with the enlargement (B) resting on the top split collar and the lower end of the capillary (E) 25 mm from the bottom of the bath. Up to eight viscometers may be conveniently mounted in one bath. The viscometer is shown mounted in its bath in Figure 3.

(b) The three way stopcock may have the curved outlet connected to a vacuum manifold, to make the charg-

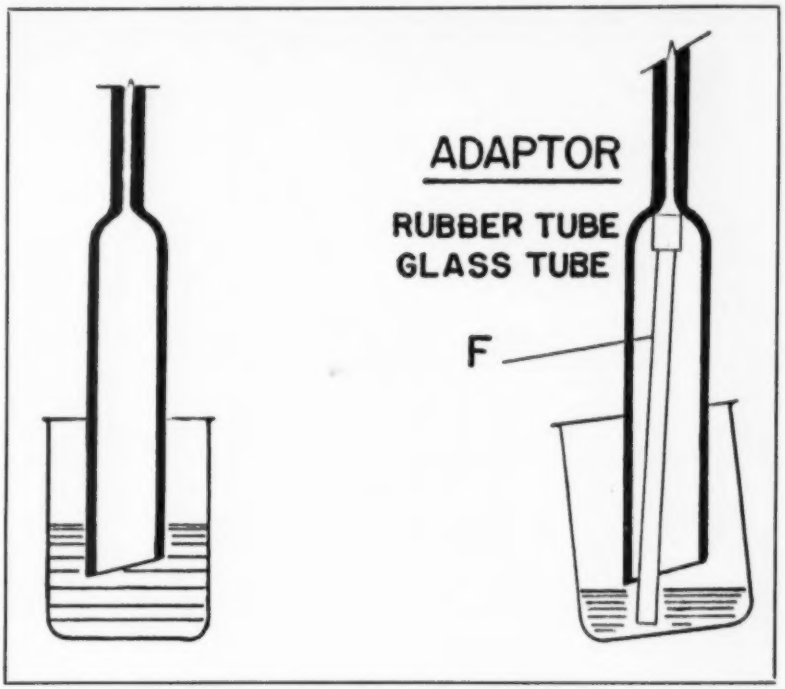


Figure 4. Alternate methods of charging sample.

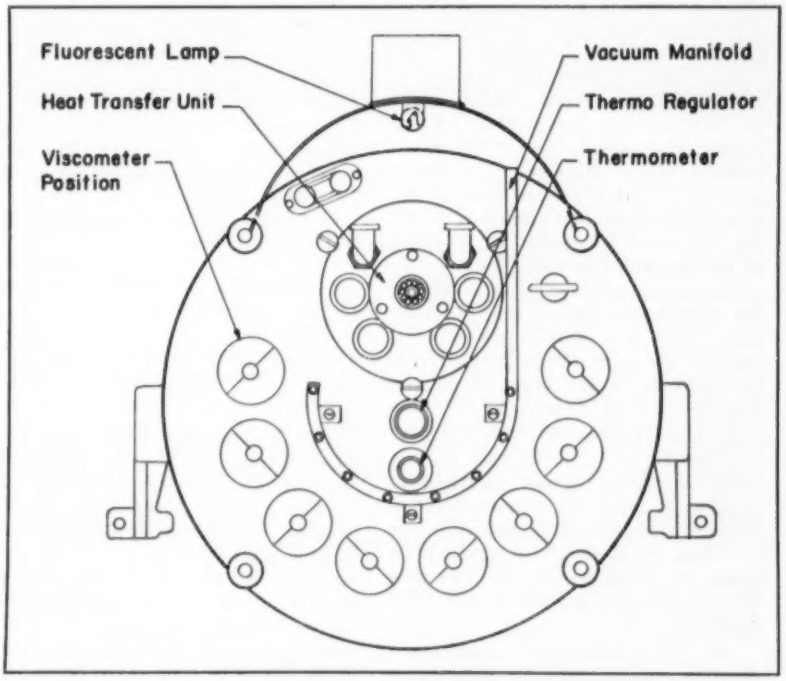


Figure 5. The viscometer bath.

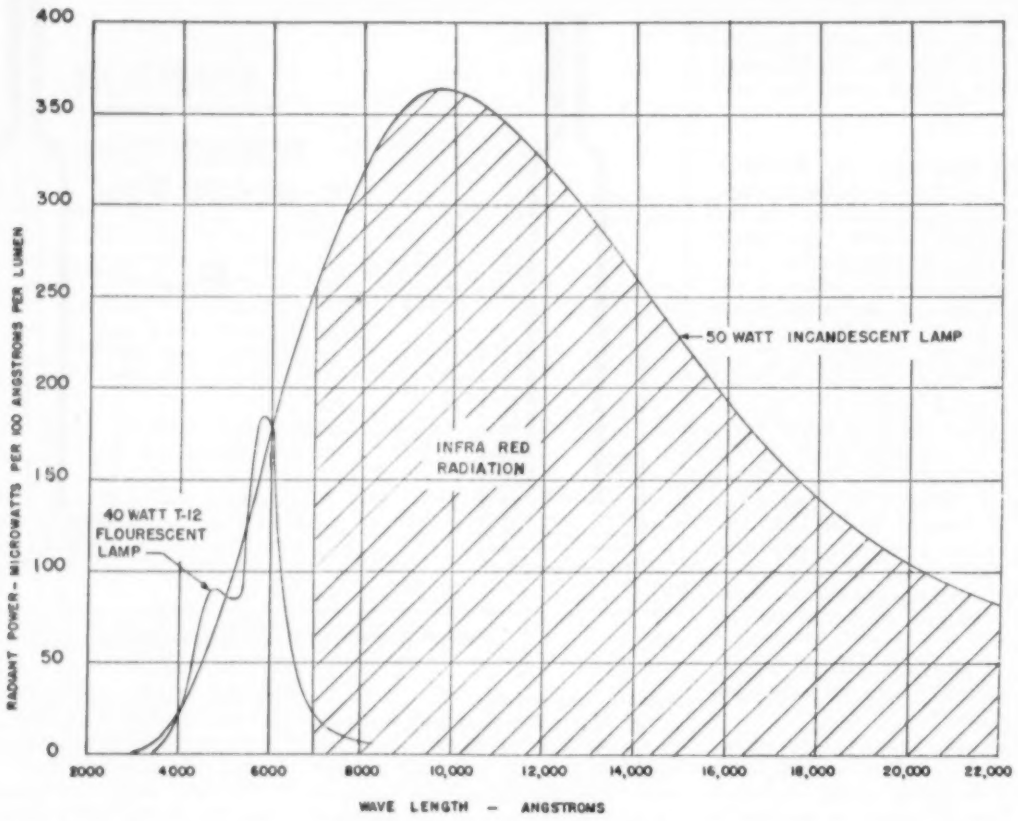


Figure 6. Comparison of spectral energy distribution of 40-watt fluorescent and 50-watt incandescent lamp. (Courtesy, General Electric Company, Lamp Division.)

ing of the viscometer a simple operation.

(c) Pour the filtered sample into a carefully cleaned 50-ml beaker. Charge the viscometer by positioning the beaker and sample under the lower opening of the viscometer so that it will be completely immersed in the sample throughout the period of charging. Figure 4 illustrates the position of the beaker while charging.

Carefully apply vacuum by turning the three-way stopcock (A) to vacuum. Draw the sample into the viscometer until the upper bulb (C) is approximately half filled. Turn the stopcock to vent, then close the stopcock (A) holding the sample in the viscometer.

(*Note:* If only a small portion of sample is available, charge the viscometer by the alternate method shown in Figure 4. Draw the sample up by means of the rubber tipped glass tube (F) which is applied to the end of the capillary.)

(d) Allow the sample to reach temperature equilibrium (5 minutes at 100 F. and 10 minutes at 210 F.). Turn the stopcock to vent which allows the sample to flow freely out of the viscometer.

(e) Measure the time required for the meniscus to pass from the first timing mark to the second. The time in seconds should be measured within 0.1 second or less.

(f) Calculate the kinematic viscosity as follows:

$$\text{Kinematic Viscosity, cs} = Ct$$

where:

C = viscometer constant[9]

t = observed efflux time in seconds

The Viscometer Bath—The Tentative Method of Test for Kinematic Viscosity ASTM Designation D445-53T stipulates that the viscometer bath be capable of maintaining a temperature control within ± 0.02 F. of test temperature. It has been demonstrated that the precision of viscosity measurements is directly dependent on the preciseness with which the bath temperature can be controlled. Because of the importance of temperature control, special attention was given to this requirement in the design of the bath for the Atlantic viscometer.

The requirements of an acceptable bath are:

1. Preciseness of temperature control
2. Firm mounting of the viscometers
3. Vertical alignment of the viscometers
4. Facility in observation of the timing marks

The precision of temperature control of the Atlantic viscometer can be attributed to its basic design. The plan view of the bath shown in Figure 5 indicates the location of the viscometers, heat transfer unit and the thermoregulator. The circular design eliminates possible "dead" spaces in the circulation of the bath medium.

The heat transfer unit consists of a pump, coiled tubing (for steam or refrigerant) and electrical heaters. These heating elements are encased in a chrome brass cylinder. A high torque air motor pumps the bath medium over the heating elements at a high rate. The immediate transfer of heat input to the entire bath medium makes

possible a functional precision of ± 0.02 F. In addition to serving as the body for the heat transfer unit, the cylinder absorbs any infrared radiations given off by the electrical heaters. The entire heat transfer unit can be removed from the bath in a few minutes for repair or replacement, reducing shutdown time to a minimum.

A 500-watt (low lag) holding heater in series with a variable transformer maintains the bath at just below the test temperature, while a 50-watt regulating heater gives a "feather" control of ± 0.02 F. A thermoregulator in series with a relay circuit, operating on a maximum load of 0.8 milliamps, actuates the input to the 50-watt heater. The low amperage across the mercurial contacts contributes to a long life of the thermoregulator. Table 4 gives the maximum temperature differential experienced in different sections of the bath as measured with a platinum resistance thermohm.

TABLE 4

Test Temperature	Temperature Differential
100 F.	± 0.001 F.
210 F.	± 0.015 F.

Distilled water is used as bath medium for temperatures from the dew point to 210 F. The high specific heat of water insures good heat transfer to the viscometers and good visibility of the timing marks.

Firm mounting of the viscometers is insured by two-point suspension. The viscometer is an integral part of the bath. It is sealed in the base plate and supported with bushings in the top plate.

The top and base plates are machined in such a way that when the bath is assembled with viscometers, the vertical alignment of all the viscometers is effected in one leveling operation. When the viscometer bath is installed in a permanent level position, the vertical alignment of the viscometers is insured.

Locating the viscometers on a circle of 3¾-inch radius permits easy observation of the timing marks. The illumination is provided by a 6-watt fluorescent lamp mounted behind the heat transfer unit (Figure 5). The fluorescent lamp was chosen because of its low infrared energy distribution (Figure 6). The sample in the viscometer absorbs infrared radiations to a higher degree than does the bath medium; this is especially true of the darker colored oils.[11] Thus the temperature of the sample liquid will be higher than the bath medium and the thermometer will be measuring an apparent sample temperature. Anomalies caused by infrared radiations from the immersion heaters and the bath illumination are thereby reduced to a minimum.

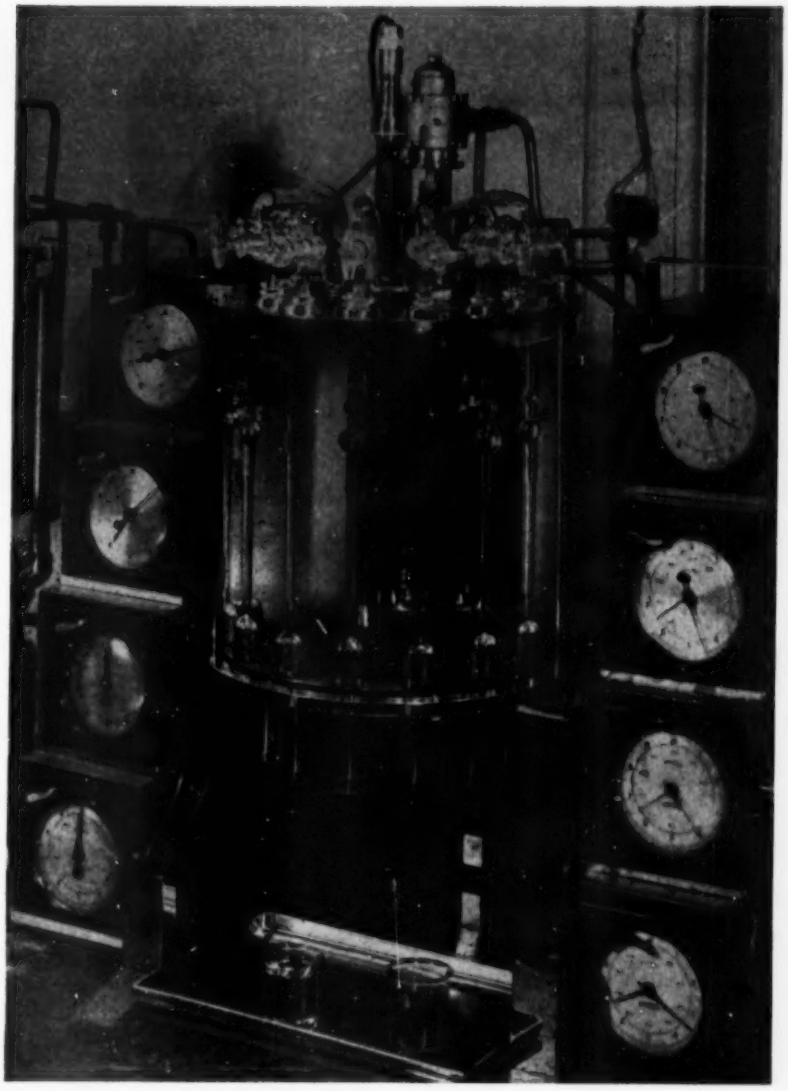


Figure 7. Viscometer assembly.

The Atlantic viscometer bath was designed on the principle of fine control of heat exchange rather than heavy insulation and heat input. The ease with which the viscometers are cleaned, filled and discharged is reflected in a long service record for each viscometer. A low breakage record shows the life of many viscometers exceeding 15 years. Once the viscometer is sealed into its bath and connected to the vacuum manifold (used for filling and cleaning) it does not have to be handled for many months. A typical viscometer installation is shown in Figure 7. # #

ACKNOWLEDGMENT

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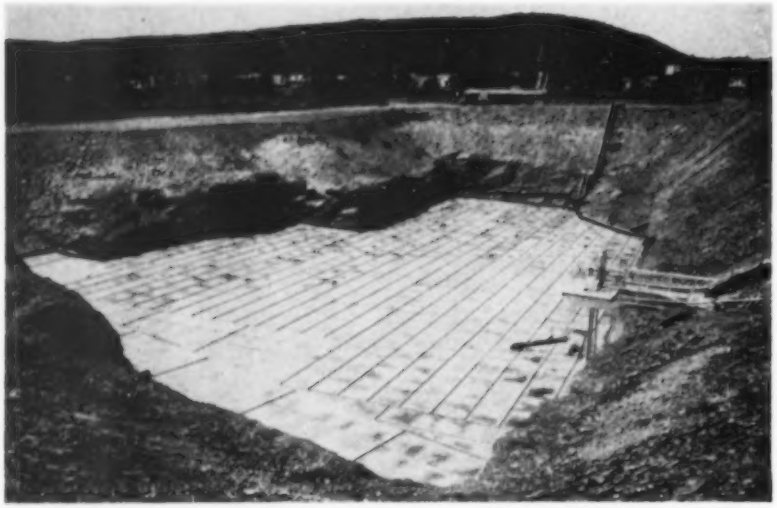

Steel pontoons, weighing almost three tons each, form a 56,000 square-foot flexible, floating roof.

Heating Oil to Quarry Storage

• In the first attempt in this country to utilize the oil-storage potential of idle mines and quarries, Esso sends heating oil to a million-barrel capacity quarry at Wind Gap, Pa.

FIRST SHIPMENTS of heating oil destined for seasonal storage in an abandoned slate quarry were scheduled for delivery recently by Esso Standard Oil Company in the first attempt in this country to utilize the oil-storage potential of idle mines and quarries. The quarry is in Wind Gap, Pa., 75 miles from New York City.

Conversion of the 56,000 square-foot pit, which ranges up to 225 feet deep, will permit storage of 42 million gallons of heating oil produced in the summer to meet peak winter demands.

The $500,000 project has been underway for more than a year and neared its final phase with the completion of tests of the 65-mile pipe line that will move the oil from Esso's Bayway Refinery in Linden, N. J. The six-inch line, which lies within 1500 feet of the quarry, existed prior to the project and is leased for the purpose.

Under full operating conditions, oil will enter the pit at the rate of 6000 barrels a day and be withdrawn at 8000 barrels. During the initial stages, less than full capacity will be employed. In the winter months, the product will be returned to the refinery for shipment to distributing points in the northeast area.

Although it plans the use of only one storage unit for the present, Esso has purchased or holds under option nine quarries in the area with a total potential capacity of 8 million barrels.

The economics of such underground storage under actual operating conditions will have to be studied before the project can be deemed fully successful, it was said. This may require a year or more of practical experience.

"The ability to put into 'dead' storage large quantities of heating oil produced in the slack summer months for delivery at the height of the heating season could reduce substantially wide seasonal swings in refinery production and product transportation," H. G. Mangelsdorf, general manager of manufacturing, declared.

The solid slate quarry is covered with a flexible, pontoon roof made up of 250 steel sections which protects the oil from air borne contamination, wild life and direct sunlight. The steel sections, weighing almost three tons each, ride on the surface of the oil. A three-foot shelf overhangs the quarry covering the area between the roof and the quarry wall.

The storage unit consists of two quarries, one of which acts as a water reservoir to control the level of oil in the other. Oil is pumped into the quarry at the surface while water is withdrawn at the bottom to accommodate the oil at least 20 feet below the surrounding water table. The water pressure on the outside of the quarry being greater than the pressure of oil in the pit, the oil is sealed effectively against leakage. Any seepage will be in the direction of the quarry with water filtering into and under the oil. When oil is withdrawn, water is pumped from the adjacent quarry to maintain a relatively constant liquid level.

This type requires less than 10 percent of the steel requirement of above-ground storage. Its maintenance and depreciation are lower and damage from storm or bombing attack would be negligible.

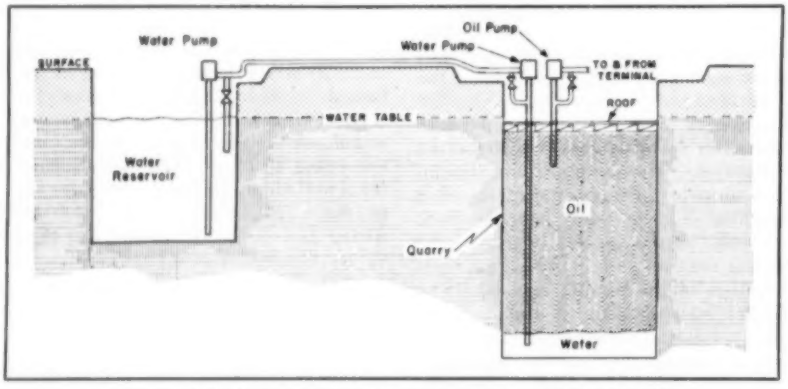

Diagram of Esso's unique seasonal storage operation at Wind Gap, Pa.

Figure 1. Stainless steel weld: In carbon steel plate, no sharp attack after one year's service.

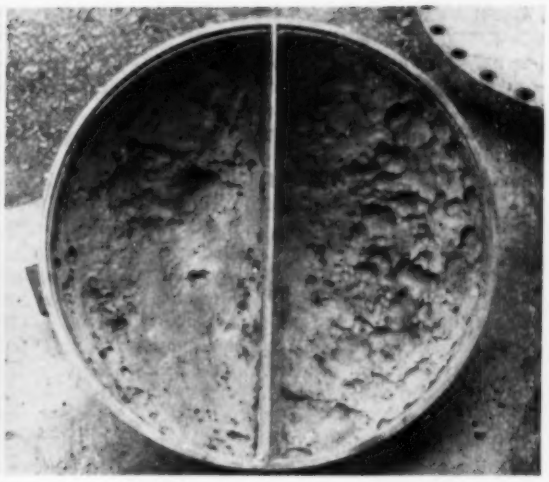

Figure 2. Steel water box: Under coating defect, corrosion after one year.

Its problems can be controlled . . .

Sea Water as an Industrial Coolant

Part 1 I. Operating Conditions
Part 2 II. Equipment Experience

W. B. Brooks,
The Dow Chemical Company,
Freeport, Texas

SEA-WATER cooling on a scale now exceeding one million gallons per minute has proven practical and economical on the basis of more than ten years experience at The Texas Division of The Dow Chemical Company near Freeport, Texas. Handling such a volume involves many conditions ranging from near stagnation to high velocity and great turbulence. Naturally, there are corrosion problems, but they can be controlled.

Sea Water as a Corrodent—The mineral content of sea water is both a blessing and a curse. It provides magnesium and bromine. Its high electrical conductivity, together with its calcium and magnesium content, make it an ideal medium for the application of cathodic protection.

TABLE 1[1]
Partial List of Elements and Radicals Present in Sea Water

Element or Radical	mg-atoms/liter
Chlorine	548.3
Sodium	470.15
Magnesium	53.57
Sulfate	38.24
Calcium	10.24
Potassium	9.96
Bicarbonate	2.34
Bromine	.83
Boron	.43
Strontium	.15

Dissimilar metals may be safely coupled where anode-cathode area ratios are high, as in the case of bronze-trimmed cast iron valves. Here, because of the high conductivity of the sea water, the current drawn by the small cathode (bronze) is distributed over the surface of the large anode (cast iron). Put another way, the anodic current density is low, therefore the corrosion rate of the cast iron is low.

In quiescent clean sea water, the average corrosion rate of mild steel around the world is about 5 mils per year. This figure is not affected to any practical extent by minor alloy additions, impurities or manufacturing methods.

It will be noted that the 3 percent chromium addition is distinctly beneficial. This composition, however, is not a commercial one for structural steel. As the chromium content is increased further, pitting becomes quite severe. Reasons for this behavior will be seen in the subsequent discussion on galvanic corrosion. LaQue suggests[2] that the controlling factor in the corrosion rate of the materials in Table 2 is the diffusion of oxygen through the barrier of rust and marine growths which accumulate on the surface. In the case of the 3 percent chromium steel, the rust is more impervious.

Bacterial Corrosion—Although the matter has received little attention

TABLE 2[2]
Corrosion of Different Compositions of Iron and Steel When Immersed in Sea Water at Kure Beach, North Carolina

Material	Exposure In Years	Corrosion Rate Mils/Year
Low Carbon Steel	6	6.6
Copper Bearing Steel	10	6.0
Hand Puddled Wrought Iron	6	5.9
2 Percent Nickel Steel	10	6.6
1.3 Percent Ni, .74 Percent Cr, 3 Percent Mo	8	5.5
3 Percent Chromium	10	2.7

in the literature, it has been the writer's observation that bacterial action is a factor in most sea water corrosion of iron and steel. A massive corrosion product near the steel surface will be black and foul-smelling. It will evolve H_2S copiously in dilute HCl indicating the presence of sulfides produced by anaerobic sulfate-reducing bacteria. The subject has been studied by J. A. Caldwell and M. L. Lytle.[3] They conclude that corrosion rates due to bacterial action are low and that they may be controlled by cathodic protection. Cathodic protection applied to an old structure will cause exfoliation of the massive corrosion product, thus depriving the bacteria of a favorable environment. It also creates a high alkalinity on the steel surface, a condition unfavorable to bacterial growth.

Natural sea water is much more corrosive than a synthetic solution of similar composition.[4] Corrosion by sea water is evidently a biochemical as well as an electrochemical problem. Similarly, the corrosiveness of oil field brines has not been duplicated with synthetic solutions.[5] LaQue and Stewart[4] found natural sea water to be from 2.7 to 18.5 times as corrosive as synthetic sea water in a series of tests on a group of non-ferrous alloys. The difference is probably associated with traces of organic matter, especially sulfur compounds, related to algae, bacteria and decaying marine organisms. This is suggested by a marked daily and even hourly variation in the corrosiveness to copper of sea water samples taken from the same location. Such behavior has been noted by T. Howard Rogers.[6] Rogers determined the amount of copper in milligrams dissolved from .25 square centimeters of copper exposed for 22 hours under rigorously controlled conditions and called it "The Copper Corrosion Index." The index may vary from 3.5 to 22, indexes over 12 usually being associated with polluted waters. Such variations have been confirmed by F. L. LaQue at Wrightsville Beach, N. C.,[7] and by the writer at Freeport where the index varied from 3 to 16, averaging about 7. An index of 7 is normal for high salinity unpolluted sea water. Sulfides in sea water appear to be damaging indeed. Sewage pollution of Los Angeles Harbor during World War II caused excessive tube losses there. Apparently the films formed by sulfides are strongly cathodic and at the same time susceptible to local damage. Such a condition provides a high cathode-anode area ratio leading to high anodic current densities and high corrosion rates where the film is damaged.

Metals and Alloys in Sea Water—The corrosion behavior of a metal should be regarded as its capacity to form a protective film in a given environment. Copper, for example, will not corrode appreciably in quiescent sea water but the film formed is not tenacious and it is easily eroded away. Additions of zinc, tin, aluminum, nickel and iron substantially improve its ability to form a protective film and alloys such as 90:10 cupro-nickel with 1.25 percent Fe, 70:30 cupro-nickel with .5 percent Fe, aluminum brass, Monel metal and composition G bronze are useful in sea water.

Experimentally, an increase from 40 to 90 F. would double the corrosion rate of steel in sea water. Such effects are not necessarily realized in practice. Over 110 F. calcium compounds start to be precipitated, forming a protective layer. Likewise oxygen solubility decreases. In any case, the exposure of test panels in many parts of the world has pretty well established that the corrosion rate of steel in quiet unpolluted sea water will lie between 3 and 6 mils per year regardless of location.

For comparison, in Mississippi River water, 50 miles above St. Louis, a rate of 1.4 mils per year has been observed.[8] In the Allegheny River, 50 miles above Pittsburgh, a rate of 4.1 mils per year has been reported.[8] This might be considered typical of an average unpolluted river. On the Monongahela River, 15 miles above Pittsburgh, the rate is 6.4 mils per year. The pH at this station was 3.4-4.8.[8]

Fouling in Sea Water—Marine fouling organisms will become attached to practically any solid surface; i.e. glass, billiard balls, stainless steel, coal tar enamel, structural steel, etc., when the velocity of the sea water is less than 3-6 feet per second depending on the roughness of the surface involved. Thus the dream of a perfect coating or perfect alloy for ship hulls must still face the problem of fouling.

Copper and copper compounds form the basis of most marine anti-fouling paints. It is not clear whether this is due to toxicity of the copper or to the organism sloughing off from a soft film of cupreous corrosion product. The latter view was discussed by the late Wm. F. Clapp, an authoritative marine biologist.[9]

In order to remain free of fouling, copper or a copper-bearing alloy must corrode at a rate which will liberate copper at a rate of 5 mg per square dm per day. In a cupreous anti-fouling paint, the steady state minimum effective leaching rate is 10 micrograms per equare centimeter per day.[10] If copper becomes cathodic through galvanic coupling with steel or other less noble metal, it will foul. Similarly, highly corrosion-resistant copper alloys, such as aluminum bronze, in low velocity water will foul. Nickel-copper alloys containing less than 50 percent copper will foul.

Heavy fouling is probably mildly protective to steel. On the other hand it is seriously damaging to most stainless steels and nickel. It will cause some pitting of Monel metal. Reasons for this action are twofold. A small crevice formed by the attachment of an oyster shell or barnacle becomes the site of an oxygen concentration cell in which the shielded area is the anode and the surrounding bare metal the cathode. Such cells cause the highly destructive pitting of 18-8 stainless steel. The electromotive driving force in such a cell is 450 millivolts. Compare this with the well known galvanic couple steel-copper which has only 250 millivolts. The destructive nature of the concentration cells caused by fouling is aggravated by the development of sulfate-reducing bacteria in the carcass of the dead organisms. Cathodic protection will stop this form of attack.

When economics permit, the most desirable method of controlling fouling is by continuous chlorination to a residual of .5 ppm. We have found that this amount will effectively control fouling and that it has little effect on the corrosion of either the nonferrous metals or steel.[11,12] At condenser tube velocities, continuous chlorination in the range of .25-.5 ppm even appears to be beneficial to 70:30 cupro-nickel.

Many marine organisms have the capacity of sealing themselves off from noxious water for extended periods and concentrations of 1.5 to 3 ppm of chlorine are required for control with intermittent chlorination.

Galvanic Effects with Dissimilar Metals in Sea Water—The high conductivity of sea water minimizes galvanic corrosion where area relationships are favorable. High anode-cathode area ratios give a low anodic current density. The utility of bronze trimmed cast iron valves has been mentioned in this connection. Similarly, stainless steel or Monel metal welds may be used with steel (Figure 1). Another reason for the successful use of stainless steel welds is that the stainless polarizes quite readily. Because of the high conductivity of sea water the

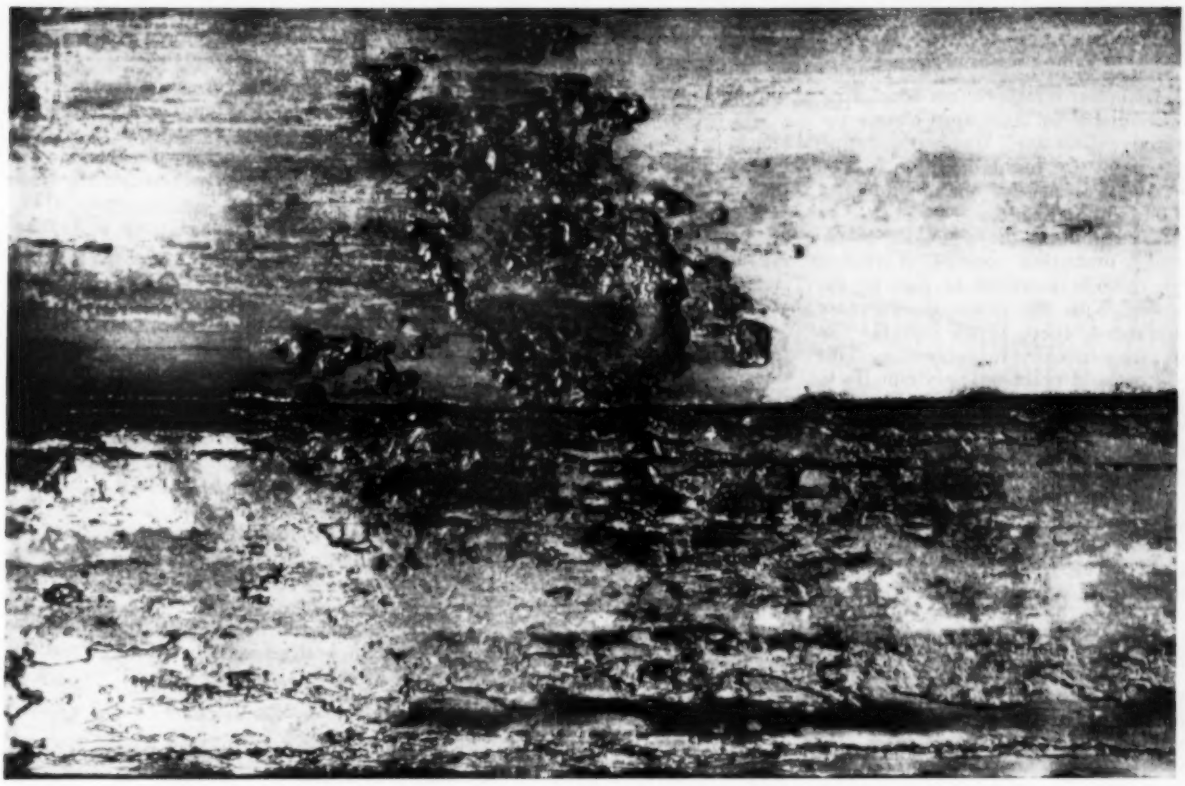

Figure 3. Split condenser tube: Impingement attack due to obstruction.

small cathode (Monel, bronze, stainless, etc.) can draw its current from large areas of anode (steel or cast iron) with the galvanic corrosion distributed over such a large area that there is no appreciable damage. Conversely, the noble metal receives cathodic protection from the steel or cast iron. Thus 25-20 stainless steel welds in low carbon or low alloy steel such as armour plate are very satisfactory, whereas 25-20 weld deposits without this protection are subject to pitting and possibly stress corrosion cracking.

Where small areas of steel are coupled to large areas of noble metal, very high and destructive corrosion rates result (high anodic current density). Cases of this type result where steel rivets are accidentally incorporated in a Monel metal structure, or where steel coupled to a noble metal is painted (Figure 2.) The large cathode draws its current from defects in the coating resulting in a very high anodic current density. When it is desired to reduce galvanic corrosion by painting, the cathode or noble metal should be painted to reduce its exposed area.

A galvanic series of metal and alloys in flowing sea water is listed in Table 3. Two potentials are listed for the stainless steels, the less noble potentials corresponding to their active state, and the noble potentials to their passive state. Both states may coexist on the same piece, explaining in part

TABLE 3[2]

Arrangement of Metals and Alloys in a Galvanic Series Based on Potential Measurements in Sea Water.

(Velocity of Flow: 13 ft. per sec.; Sea Water Temperature: 77 F.)

METAL	Steady Potential Negative to Saturated Calomel Half Cell, Volts
Zinc	1.03
Aluminum (Alclad 3S)	0.94
Aluminum 3SH	0.79
Aluminum 61ST	0.76
Aluminum 52SH	0.74
Cast Iron	0.61
Low Carbon Steel	0.61
Stainless type 430 (active)	0.57
Ni-Resist (20 Percent Ni.)	0.54
Stainless type 304 (active)	0.53
Stainless type 410 (active)	0.52
Ni-Resist (30 Percent Ni.)	0.49
Ni-Resist (No. 0 Percent Ni plus Cu)	0.46
Naval Rolled Brass	0.40
Yellow Brass	0.36
Copper	0.36
Red Brass	0.33
Composition G Bronze	0.31
Admiralty Brass	0.29
90:10 Cupro-Nickel, .8 Percent Fe	0.28
70:30 Cupro-Nickel, .06 Percent Fe	0.27
70:30 Cupro-Nickel, .47 Percent Fe	0.25
Stainless type 430 (passive)	0.22
Nickel	0.20
Stainless type 316 (active)	0.18
Inconel	0.17
Stainless type 410 (passive)	0.15
Titanium (commercial)	0.15
Silver	0.13
Titanium (high purity iodide)	0.10
Stainless type 304 (passive)	0.08
Hastelloy C	0.08
Monel Metal	0.08
Stainless type 316 (passive)	0.05

the serious pitting which occurs with stainless steel in stagnant sea water. Pitting when it occurs, is aggravated by contact with noble metals.

It must be emphasized that all corrosion (other than direct chemical attack such as with copper in concentrated nitric acid) is electrochemical. This being so, the "expert" cannot be expected to distinguish "electrolysis" from dissimilar metals or stray currents by its mere appearance.

The interpretation of such data as those in Table 3 must be coupled with caution and experience. Zinc has a high driving force as a sacrificial anode but unless it is of high purity, it polarizes and becomes useless as an anode.[13] Aluminum alloys, especially 52S, have a high potential but may be usefully resistant in sea water. On the other hand, the data explain the pitting of stainless Type 304 and the resistance to pitting of Type 316. The high and low iron cupro-nickel alloys have very close potentials but are remarkably different in their resistance to rapidly flowing sea water. Table 4 lists the actual corrosion of a number of metals and alloys together with their open circuit potentials. From this it will be seen that it is a mistake to predict corrosion behavior from potentials without supplementary qualifying information.

Galvanic corrosion between couples of dissimilar metals cannot necessarily be predicted by their open circuit potential differences. Data illustrating this point are listed in Table 5. The departure from what one might expect is due to polarization.

By definition, the process of cathodic protection consists of raising the cathode potential to that of the anode. With the potential difference eliminated, there is no current flow and consequently no corrosion. This concept and practice apply equally to the local anodes and cathodes on a steel surface or to the anode and cathode comprised by a dissimilar metal couple. Thus it is a common practice in our plants to apply the protective current from magnesium anodes to a condenser water box of steel or cast iron coupled to a muntz metal or Monel metal clad tube sheet.

The Effects of Velocity

Cavitation Attack — In the high velocity turbulent flow of a liquid, local areas are alternately the site of vacuums and positive pressures. The vacuum momentarily results in bubble formation. The collapse of the bubble has enough force to destroy most protective films and even to remove particles of metal. It has been estimated to be as high as 60,000 psi.

This high estimate of the collapsing force of the bubble is confirmed by metallographic examination which reveals slip bands and fatigue cracks in metal subject to cavitation attack.[14,15]

It is believed by many that cavitation is strictly a mechanical phenomenon but it is illogical to assume that a site denuded of a protective film and subject to shattering impact is not also a site of corrosive attack. Cavitation attack has reportedly been prevented by cathodic protection. It is significant that metals resistant to cavitation attack are strong, ductile and corrosion resistant. Indeed the most resistant materials are the chromium nickel stainless steels which have a marked capacity to work harden.[16,17]

Cavitation attack occurs on pump impellers and casings. The severity depends upon the speed and head of the pump. Composition G bronze, Ni-Resist, S Monel, and worthite in appropriate service conditions make satisfactory impellers.

TABLE 4[4]

Relationships Between Open Circuit Potentials and Corrosion Rates of Metals in Sea Water Flowing at 13 Feet Per Second at at 77 F.

METAL	Steady Potential Relative to Sat. Calomel Half Cell Volts	Corrosion Rates Mdd.
Zinc	1.03	1490
Aluminum 38H	0.79	45
Carbon Steel	0.61	325
Naval Rolled Brass	0.40	124
Copper	0.36	106
Nickel	0.20	55
Stainless type 410	0.15	114
Hastelloy C	0.08	2

TABLE 5[5]

Couple	Actual Potential Difference at Start of Test. V.	Corrosion Rate of Steel in Couple. Mdd.	Galvanic Effect Mdd.
Steel to steel	.007	183	28
Steel to copper	.229	525	355
Steel to 304 stainless	.325	195	25
Steel to titanium	.512	224	54
Steel to nickel	.382	607	437

Impingement Attack—Impingement attack occurs on copper and its alloys. Like cavitation, it is caused by high velocity turbulent flow. It is encountered most frequently in condenser tubing where velocities are in the order of 6 to 12 feet per second. With non-resistant metals such as copper, it may occur at velocities as low as 3 feet per second. Additions to copper of zinc, zinc plus aluminum, nickel, nickel plus iron, and tin form alloys having the capacity to retain protective films to a greater or lesser degree depending on the service.

Impingement attack is caused by the continuous local destruction of protective films by turbulent rapidly flowing water. The site of film breakdown becomes anodic with respect to the large surrounding filmed areas which function as cathodes and pitting results. The pits are frequently undercut on the upstream side, and they often assume a horseshoe shape with the tails of the horseshoe pointing downstream.

The precise kinetics of impingement attack are, to say the least, confused. It has long been held that the release of dissolved oxygen and entrained air cause inlet end corrosion and impingement attack. There is of course little doubt that dissolved oxygen accelerates corrosion through its ability to depolarize cathode areas. In jet impingement tests conducted by LaQue,[18] entrained air bubbles were not especially harmful, and impingement attack could be produced without entrained air bubbles.

With a nominal velocity of 7 feet per second, turbulence sufficient to cause impingement attack will exist in carefully belled tube ends. In many industrial installations, the water boxes are cast iron. The corrosion of the water box coupled to the tube sheet and tube ends provides them with sufficient cathodic protection to prevent tube end attack of aluminum brass and cupronickel. It is believed by some that traces of iron compounds are quite helpful in maintaining a protective film.[15,19] In the absence of bare cast iron or steel water boxes or cathodic protection, protective ferrules are used by some. Such circumstances arise when the water box is made of bronze or Monel metal, or has a non-metallic coating.

A few inches beyond the inlet, the flow tends to become laminar and no impingement attack occurs unless, as is very frequently the case, a foreign object becomes lodged in the tube. The restriction increases the velocity locally and directs the stream against the tube wall thus disrupting the boundary layer of fluid in which the flow is laminar even under moderately turbulent conditions (Figure 3). Such a situation will remove the copper ions normally present in the relatively quiescent boundary layer and cause mechanical damage to the protective film, both effects causing the formation of a local anode. ##

End of Part I. Part II will appear in an early issue.

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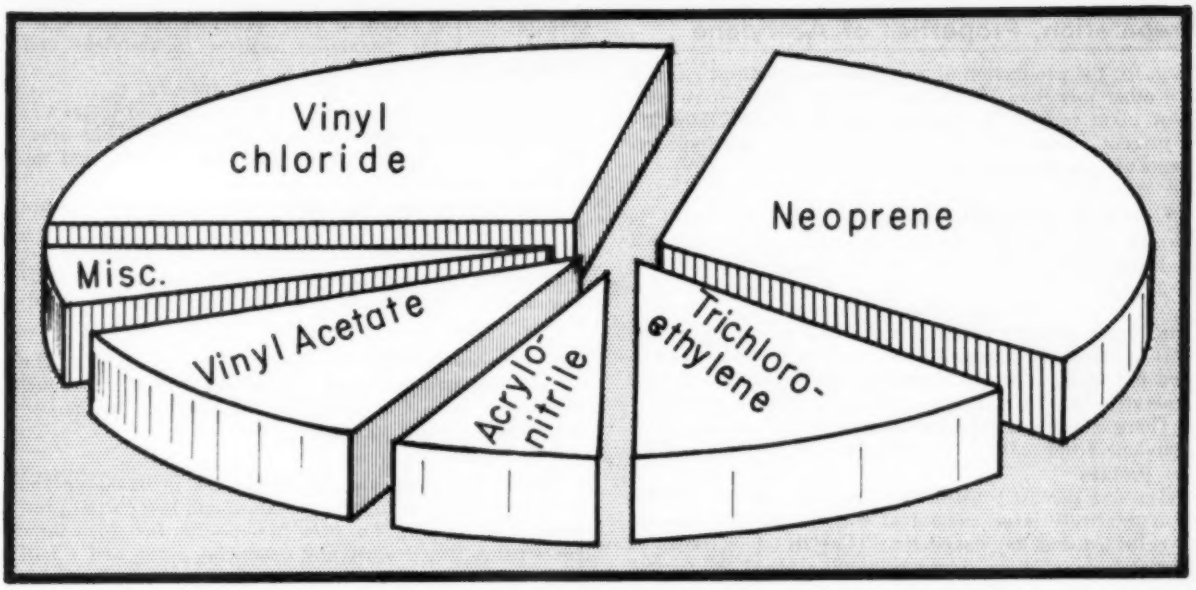


Figure 1. 1955 estimated end use pattern for 750 million pounds of acetylene. About 250 million pounds will be used for welding.

Understanding the chemistry of . . .

Petrochemical Reactions

Part 16. The Production and Reactions of Butadiene

Part 17. Preparation and Properties of Acetylenes

Lewis F. Hatch, The University of Texas, Austin

ACETYLENE is a newcomer to the ranks of petrochemicals although it has been well established for many years as a prime raw material for the chemical industry. Until a few years ago all the acetylene came from limestone, coal and water (calcium carbide). At the present time 90 percent of the acetylene still comes from this source with the other 10 percent coming from natural gas. It is predicted, however, that by 1975 the production will be 75 percent from natural gas and only 25 percent from calcium carbide.

This increase in acetylene from natural gas will not be at the expense of the older method of production but will represent new capacity to meet the demands for acetylene in the expanding end uses shown in Figure 1. This additional acetylene will also be needed for the fascinating new acetylene chemistry called "Reppe Chemistry." Acetylene is currently a very robust youngster and it has a long and happy life ahead of it. It is the purpose of this article to consider its present and explore its future.

Production of Acetylene

The traditional method for the production of acetylene is by the reaction between calcium carbide and water:

$$\underset{\text{Calcium carbide}}{CaC_2} + 2H_2O \rightarrow Ca(OH)_2 + \underset{\text{Acetylene}}{HC \equiv CH}$$

This method still accounts for the great bulk of acetylene production, and its competitive position is well illustrated by the fact that the current expansion in acetylene production includes calcium carbide based acetylene as well as the newer processes for the production of acetylene from natural gas.

The future, however, lies with acetylene from natural gas, for calcium carbide is rapidly running out of its string of potentialities. The very perfection of the calcium carbide process works against its future for there is little room in which to improve. Another limiting factor is the availability of plant sites with readily available raw materials (limestone and coke) and cheap electrical power. On the other hand there is one process (Sachsse) in oper-

ation for the production of acetylene from natural gas and two other processes (Wulff and Schoch) which have been pilot plant tested. The Sachsse and Wulff processes are at present competitive with calcium carbide, and improvements may be expected in the future.

Calcium Carbide Process—Calcium carbide is formed when lime and coke are mixed in a ratio of 6 to 4 and heated in an electric furnace to a temperature of 2000 to 2100 C.

$$CaO + 3C \rightarrow CaC_2 + CO$$

The liquid calcium carbide is allowed to solidify; then it is crushed and screened for size. This operation is carried out under nitrogen to prevent explosion of acetylene generated from any moisture which might be present.

There are two standard processes for the generation of acetylene from calcium carbide: the wet process and the dry process.

The *wet process* consists of adding the calcium carbide to a relatively large amount of water. The acetylene gas is collected and the slaked lime [$Ca(OH)_2$] is recovered in the form of lime slurry containing about 90 percent water.

The *dry process* reverses the order of addition with water being added to calcium carbide in a generator. This permits the addition of only enough water to liberate the acetylene. Any excess water is vaporized by the heat of reaction and substantially dry calcium hydroxide is obtained. The temperature must be controlled since acetylene polymerizes at 600 C., to form benzene and violently decomposes at 780 C. Air-acetylene mixtures explode at 480 C. As a consequence of these properties of acetylene, generators for both the wet and the dry processes are designed to operate below 150 C. and 15 psi.

The acetylene is essentially pure and requires only a water and caustic scrubbing or treatment with iron oxide or active chlorine compounds to remove traces of hydrogen sulfide, ammonia and phosphine. A sulfuric acid wash may also be used.

An interesting variation on this process for producing acetylene is the proposal to use refinery coke in place of coke from coal for the production of the calcium carbide. The acetylene thus produced would be at least half petrochemical in origin.

Sachsse Process—The Sachsse partial oxidation process for the production of acetylene from natural gas is the only petrochemical process now in full scale operation. Monsanto Chemical Company, Carbide and Carbon Chemicals Company, and American Cyanamid Company are the three companies using this process; the other four acetylene producers in this country use calcium carbide exclusively. It is of interest to note that all acetylene producers are chemical companies. One of the reasons for this is the difficulty in transporting acetylene. It is used where it is produced. Several petroleum companies, however, have shown interest in the field.

In the Sachsse process oxygen and natural gas are preheated separately in direct-fired heaters to about 515 C., and then mixed at an oxygen-natural gas ratio of 0.65:1.00 (Figure 2). The resulting flame provides the heat necessary to crack the remaining methane to acetylene and hydrogen.

$$2CH_4 \rightarrow HC \equiv CH + 3H_2$$

About one-third of the methane is cracked and the rest is burned. The flame temperature is about 1500 C., the operating pressure slightly greater than atmospheric, and the residence time is 0.001-0.01 seconds.

Table 1 gives the composition of a typical gas mixture produced by the Sachsse process.

This mixture is first compressed to 150 psig, and the higher acetylenes are removed by scrubbing with a paraffinic oil. The acetylene is then removed by a selective solvent such as dimethyl formamide [$HC{-}N(CH_3)_2$] . The acetylene is stripped from the solvent to give a product 99 percent pure. The overall yield based on the carbon in the natural gas is 30 percent.

TABLE 1

Products from the Partial Oxidation of Methane (Sachsse Process)

Acetylene	8.5%
Hydrogen	56.0
Carbon monoxide	25.0
Carbon dioxide	3.5
Methane	6.5
Higher acetylenes	0.5

Wulff Process—The Wulff process is based on the cracking of LPG at high temperature and low partial pressures. A small plant has been in operation for about three years using this process and producing a ton and a half of acetylene per day. A variety of feed stocks has been used including methane, ethane, propane, butane and a number of hydrocarbon mixtures. The heart of the process is the regenerative furnace which thermally cracks the hydrocarbon through a continuously heating and cracking cycle. The cracking temperature is between 1200 and 1400 C., and the pressure is 15 inches of Hg absolute. The total time the gases are in the furnace is about 0.1 seconds.

Table 2 gives a typical cracked gas composition using propane and natural gas.

It is estimated that a full scale Wulff process plant would have to have an annual capacity of at least 20,000,000 pounds to be economical. Such a plant would make acetylene from propane at about 6.75 cents a pound and from natural gas at about 6 cents a pound.

Schoch Process—The Schoch process has the hydrocarbon pass through a spread electric discharge. This process apparently is not competitive with the Sachsse or Wulff processes because of power costs. It does have the advantage of being able to operate in smaller units than the other two processes.

Reaction of Acetylene

The fact that acetylene is potentially the most valuable starting compound for organic synthesis has been known for many years. The delay in taking advantage of this fact has been caused, in part, by some of the less desirable properties of acetylene, such as its highly endothermal character (its heat of formation is 3870 Btu per pound).

TABLE 2

Typical Cracked Gas Composition from Wulff Pilot Plant

COMPOUNDS	FEEDSTOCK	
	Propane Vol. percent	Natural gas Vol. percent
Acetylene	9.6	5.5
Ethylene	7.0	0.8
Methane	15.1	25.8
Ethane	0.1	0.1
Higher acetylenes	0.8	0.6
Higher non-acetylenes	0.3	0.3
Hydrogen	50.8	51.5
Nitrogen	6.6	5.6
Carbon monoxide	8.2	8.2
Carbon dioxide	1.5	1.6

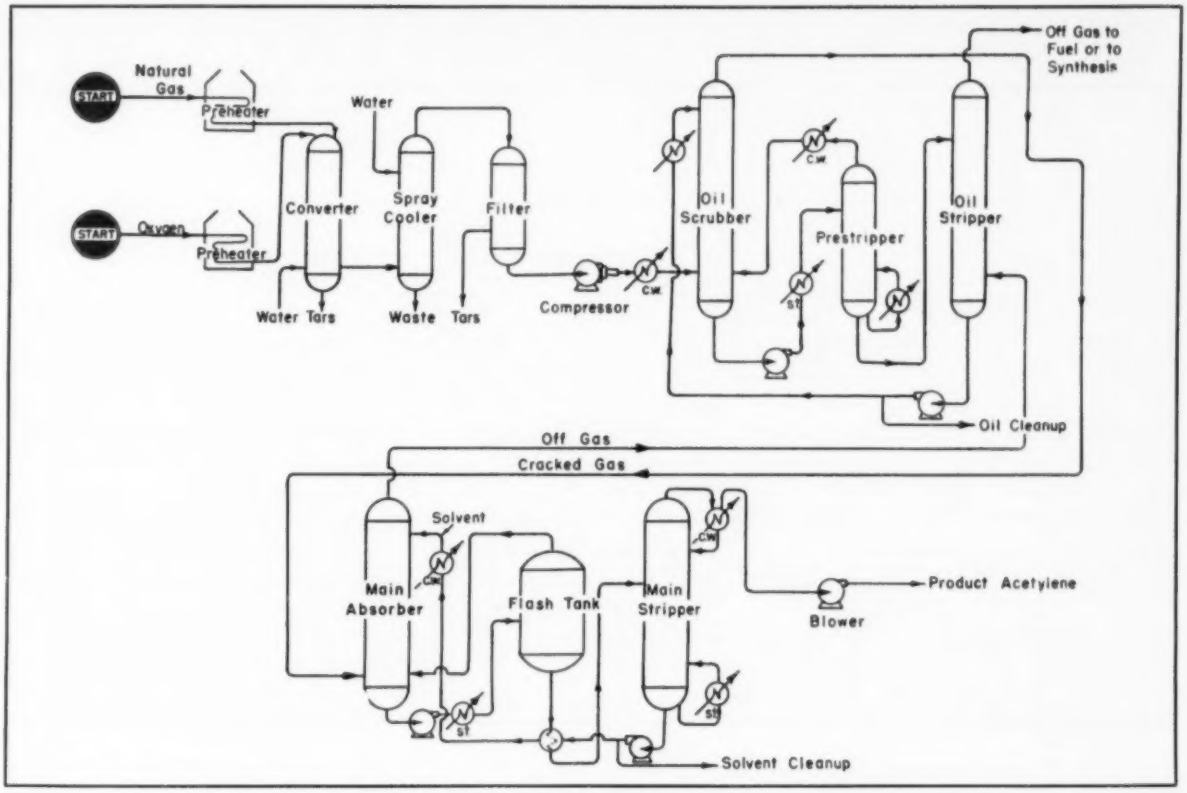


Figure 2. Production of acetylene by the Sachsse process.

Practically every reaction it undergoes liberates large amounts of heat which present engineering problems. Acetylene and oxygen form explosive mixtures over a very wide range of concentrations, and acetylene alone will explode at relatively low temperatures and pressures. It also forms metal acetylides, some of which are explosive.

On the credit side, acetylene has a carbon-carbon triple bond which permits it to react by addition and give a product which is still unsaturated (a substituted olefin) and therefore reactive. Ethylene, for example, also reacts by addition, but a relatively unreactive saturated compound is the product of the reaction.

The chemical utilization of acetylene can be conveniently divided into those reactions (and products) which are well established and those reactions which are at present entering the pilot plant stage or just emerging into full scale production. This fairly sharp line of demarkation is caused by the recently developed *Reppe Chemistry*.

The organic compounds currently being produced in quantity from a acetylene are indicated in Figure 3. They are *vinyl acetate*, ($CH_3C(=O)OCH=CH_2$), *vinyl acetylene* ($HC\equiv CCH=CH_2$), *acrylonitrile* ($CH_2=CHCN$), *acetaldehyde* ($CH_3C(=O)H$), *vinyl chloride* ($CH_2=CHCl$) and *tetrachloroethane* ($CHCl_2CHCl_2$). Acrylonitrile and vinyl chloride are derivatives of both acetylene and ethylene, and their preparation and uses were discussed in previous articles of this series (Parts 10 and 11). Vinyl acetate and ethylidene diacetate [$(CH_3C(=O))_2CHCH_3$] produced by the addition of one or two molecules of acetic acid to acetylene, and the production of these compounds was described in Part 11. The relationship between ethylene and acetylene in respect to the commercially important two-carbon chlorine compounds was shown in Figure 3 of Part 10 of this series.

Two primary industrial reactions of acetylene are the addition of hydrogen chloride to produce vinyl chloride and the addition of chlorine to produce tetrachloroethane.

$$HC\equiv CH + HCl \rightarrow \underset{\text{Vinyl chloride}}{CH_2=CHCl}$$

$$HC\equiv CH + 2Cl_2 \rightarrow \underset{\text{Tetrachloroethane}}{CHCl_2CHCl_2}$$

The **tetrachloroethane** is produced by mixing chlorine and acetylene both of which are dissolved in tetrachloroethane. Efficient mixing is required to prevent high concentrations of either chlorine or acetylene from contacting each other. The temperature is about 80 C., and antimony trichloride and ferric chloride are used as catalysts. The tetrachloroethane is dehydrochlorinated to trichloroethylene (see Part 11).

Acetaldehyde is produced by several different methods including the oxidation of hydrocarbons (Part 4), the oxidation of ethyl alcohol, and by the hydration of acetylene.

$$HC\equiv CH + H_2O \xrightarrow[HgSO_4]{H_2SO_4} \underset{\text{Acetaldehyde}}{CH_3C(=O)H}$$

High purity acetylene (99.5 percent) at 15 psi is passed into a reactor containing mercurous sulfate in 18 to 25 percent sulfuric acid. The heat of reaction maintains a reaction temperature of between 70 and 100 C. The vapors of acetaldehyde (b.p. 21 C.), water and unreacted acetylene are scrubbed with water in which the acetaldehyde dissolves. Concentration of this weak acetaldehyde solution by distillation can give an acetaldehyde of 99 percent purity. Over 95 percent of the acetaldehyde is used in the same plant in which it is produced—another reason why

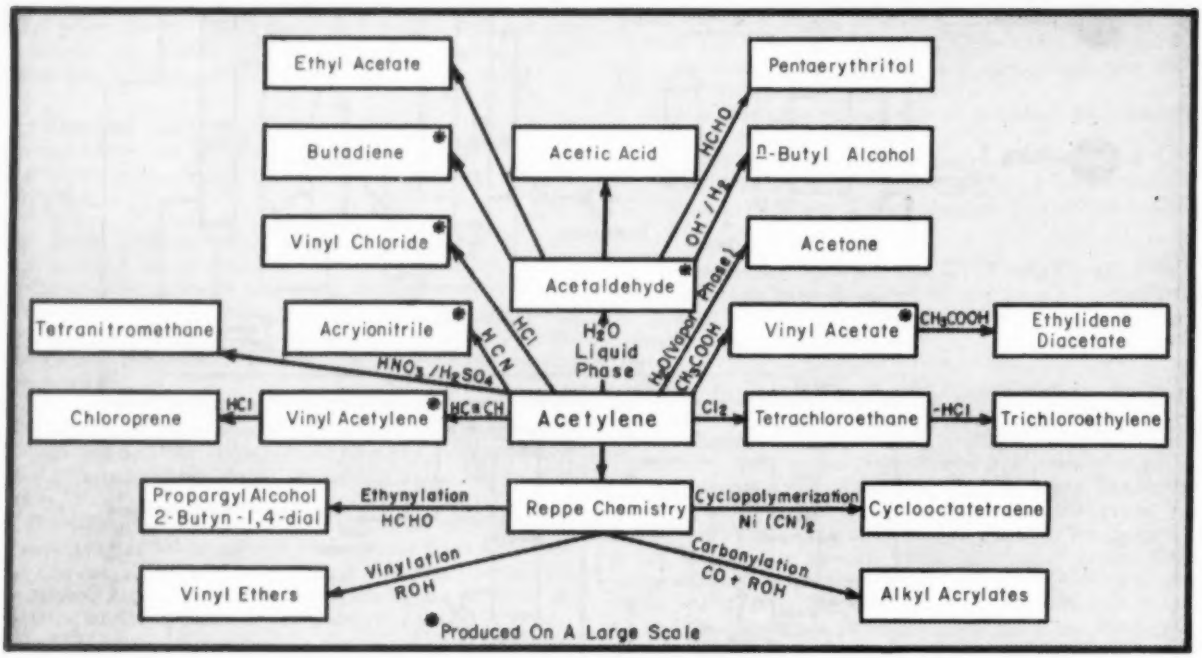


Figure 3. Chemical derivatives of acetylene.

acetylene production is in the hands of chemical companies.

Acetone can be produced from steam and acetylene by passing a mixture of the two over a catalyst bed ($Fe_2O_3 - ZnO$) at about 230 C. The catalyst life is short.

Tetranitromethane (TNM) is produced by the nitration of acetylene in a two step process. The over-all reaction is

$$HC \equiv CH + 6HNO_3 \rightarrow \underset{\text{Tetranitromethane}}{C(NO_2)_4} + CO_2 + 4H_2O + 2NO_2$$

In the first step acetylene and highly concentrated nitric acid react at 50 C., in the presence of mercuric nitrate as a catalyst to form trinitromethane **(nitroform).** Sulfuric acid is added and the trinitromethane is converted to tetranitromethane when the solution is heated. Tetranitromethane is used to increase the cetane number of diesel fuel, and it has possibilities as a military explosive.

Reppe Chemistry

Reppe chemistry is designated as that phase of acetylene chemistry involving the use of acetylene at pressures in excess of one atmosphere. In a broader sense it also includes the utilization of the products obtained under these conditions as intermediates for subsequent synthesis. Reppe chemistry derives its name from the German chemist who was instrumental in its development during World War II. Since 1941 Reppe chemistry has been under intensive and extensive investigation by General Aniline & Film Corporation and in more recent years by Air Reduction Chemical Company and Rohm and Haas Company.

There are four fundamental reactions of more or less general application. These are vinylation, ethynylation, cyclopolymerization, and carbonylation.

Vinylation—The term "vinylation" is used to designate the addition of various compounds to acetylene to yield a vinyl ($CH_2 = CH-$) derivative. Nearly any organic compound containing a reactive hydrogen atom will take part in this type of reaction. The following reactions are both typical and the ones which have received the most study.

$$\underset{\text{Alcohol}}{ROH} + HC{\equiv}CH \rightarrow \underset{\text{Vinyl ether}}{ROCH = CH_2}$$

$$\underset{\text{Mercaptan}}{RSH} + HC{\equiv}CH \rightarrow \underset{\text{Vinyl sulfide}}{RSCH = CH_2}$$

$$\underset{\text{Acid}}{RC(=O)-OH} + HC{\equiv}CH \rightarrow \underset{\text{Vinyl ester}}{RC(=O)-OCH = CH_2}$$

$$\underset{\text{Amine}}{R_2NH} + HC{\equiv}CH \rightarrow \underset{\text{Vinylamine}}{R_2NCH = CH_2}$$

$$\underset{\text{Amide}}{RC(=O)-NHR'} + HC{\equiv}CH \rightarrow \underset{\text{Vinylamide}}{RC(=O)-NR'CH = CH_2}$$

These vinylations are all carried out under the same general range of conditions. The temperature will vary between 120 and 180 C., and the pressure between 1 to 15 atmospheres. Alkaline substances are used as catalysts. Alkali metals, hydroxides or salts of weak acids are used for alcohols; mercaptans and amides, zinc and cadmium salts (acetates, benzoates and naphthenates) are used with certain acids and amines. The acetylene is always mixed with a suitable diluent such as nitrogen, propane or vapors of the reactant or solvent as a safety precaution.

Vinyl ethers are probably the most interesting type of compound produced by vinylation. Primary and secondary alcohols add readily to acetylene, but tertiary alcohols react more slowly. Phenols in general react more slowly than alcohols.

Alkyl vinyl ethers are characterized by the ease with which they are polymerized by catalysts such as boron trifluoride, stannic chloride and aluminum chloride, but they are polymerized only very slowly by free-radical in-

itiators. The polyvinyl alkyl ethers are soluble in most common organic solvents, and they are compatible with a variety of natural and synthetic resins.

The vinyl ethers will add hydrogen, hydrogen halides, halogens, hydrogen cyanide and similar substances.

Vinyl sulfides are formed by the addition of aliphatic and aromatic mercaptans under similar conditions as those used to produce alkyl vinyl ethers. The vinyl sulfides do not undergo addition reactions as readily as the vinyl ethers. Hydrogen sulfide, mercaptans and alkali metal bisulfites, however, react smoothly.

$$RSCH=CH_2 + RSH \rightarrow RSCH_2CH_2SR$$

An ethylene disulfide

The sulfides are also easily oxidized to sulfoxides, $(RS-\overset{O}{\overset{\|}{C}}H=CH_2)$, and sulfones,

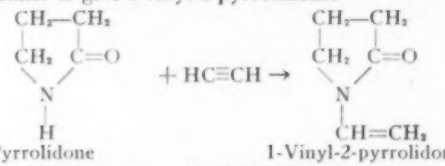
$$RSCH=CH_2 + 2H_2O_2 \rightarrow RSO_2CH=CH_2 + 2H_2O.$$

They all have disagreeable odors.

Vinyl esters formed by the addition of an organic acid to acetylene have been commercially important for a long time (vinyl acetate). Esters of high molecular weight acids require a higher acetylene pressure and a higher temperature than is used in the preparation of vinyl acetate. Zinc and cadmium salts are used as catalyst.

Vinylamines are produced only from the addition of relatively non-basic amines to acetylene. Primary and secondary aliphatic amines and the more basic aromatic amines invariably result in the formation of intractable resins.

Vinylamides are formed from carboxylic acid amides (and cyclic amides) and acetylene under pressure at temperatures between 130 and 160 C., in the presence of alkali metal salts. 2-Pyrrolidone will react with acetylene in this manner to give 1-vinyl-2-pyrrolidone.



2-Pyrrolidone — 1-Vinyl-2-pyrrolidone

Homopolymerization of vinylpyrrolidone gives polyvinylpyrrolidone (PVP) which has gained fame as a blood plasma expander. It also has many other unique properties.

Ethynylation—The term "ethynylation" is used to designate the addition of acetylene to an aldehyde or ketone to give hydroxy compounds containing the ethynyl group (HC≡C—).

$$\underset{\text{Aldehyde}}{RC(=O)-H} + HC\equiv CH \rightarrow \underset{\substack{\text{Hydroxy acetylene}\\(\text{Ethynyl carbinol})}}{RCH(OH)C\equiv CH}$$

$$\underset{\text{Ketone}}{RC(=O)R'} + HC\equiv CH \rightarrow RR'C(OH)C\equiv CH$$

The reaction is usually carried out at about 100 C., and at a pressure of 3 atmospheres or higher. The pH range is 2-7, and finely divided copper acetylide deposited on silica is the catalyst for aldehydes. Alkali, alkaline earths, or alcoholates are used with ketones. By varying the reaction conditions and the ratio of the reactants it is possible to obtain alkynediols (RCHOHC≡CCHOHR).

One of the most important ethynylation reactions is that between acetylene and either one or two molecules of formaldehyde.

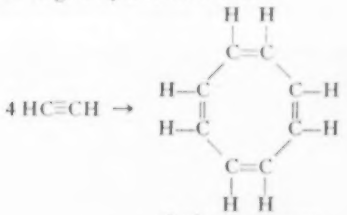
$$\underset{\text{Propargyl alcohol}\\(\text{2-Propyn-1-ol})}{\overset{O}{\overset{\|}{HC}}-H + HC\equiv CH \rightarrow HC\equiv CCH_2OH}$$

$$\underset{\text{2-Butyn-1,4-diol}}{\overset{O}{\overset{\|}{HC}}-H + HC\equiv CCH_2OH \rightarrow HOCH_2C\equiv CCH_2OH}$$

Both of these compounds are amenable to a number of different reactions, and numerous compounds are made from them. They have all of the versatility of a carbon-carbon triple bond with the added stability and reactions of an alcohol. Propargyl alcohol has the added advantage of the acid hydrogen atom of an acetylene. It is beyond the scope of this article to elucidate all the potentialities of these compounds, but they are great. The General Aniline & Film Corporation's six million dollar acetylene derivatives plant at Calvert City, Kentucky, will produce compounds based on these two alcohols.

The ketone addition products of acetylene, tertiary alcohols, are being exploited by Air Reduction Chemical Company. Apparently they will find use in synthesis, as stabilizers for chlorinated hydrocarbons and as surface active agents.

Cyclopolymerization—One of the more fascinating discoveries made by Reppe was that acetylene could be polymerized to give cyclooctatetraene.



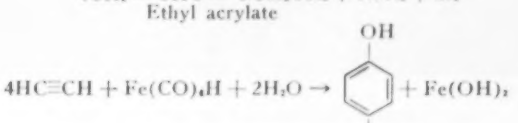
Cyclooctatetraene

The cyclopolymerization is carried out in tetrahydrofuran at 60 to 70 C., and 10 to 25 atmospheres pressure with anhydrous nickel cyanide as the catalyst. Now all one has to do is to find a use for cyclooctatetraene. It will undergo the usual reactions of an olefin, and it has a puckered structure, if that is of any help.

Carbonylation—The term "carbonylation" is given to the reaction between acetylene and carbon monoxide in which metal carbonyls are employed. The reaction gives rise to either acrylic esters or hydroquinone.

$$4HC\equiv CH + 4C_2H_5OH + Ni(CO)_4 + 4HCl \rightarrow$$

$$\underset{\text{Ethyl acrylate}}{4CH_2=CHC(=O)-OCH_2CH_2} + NiCl_2 + H_2$$



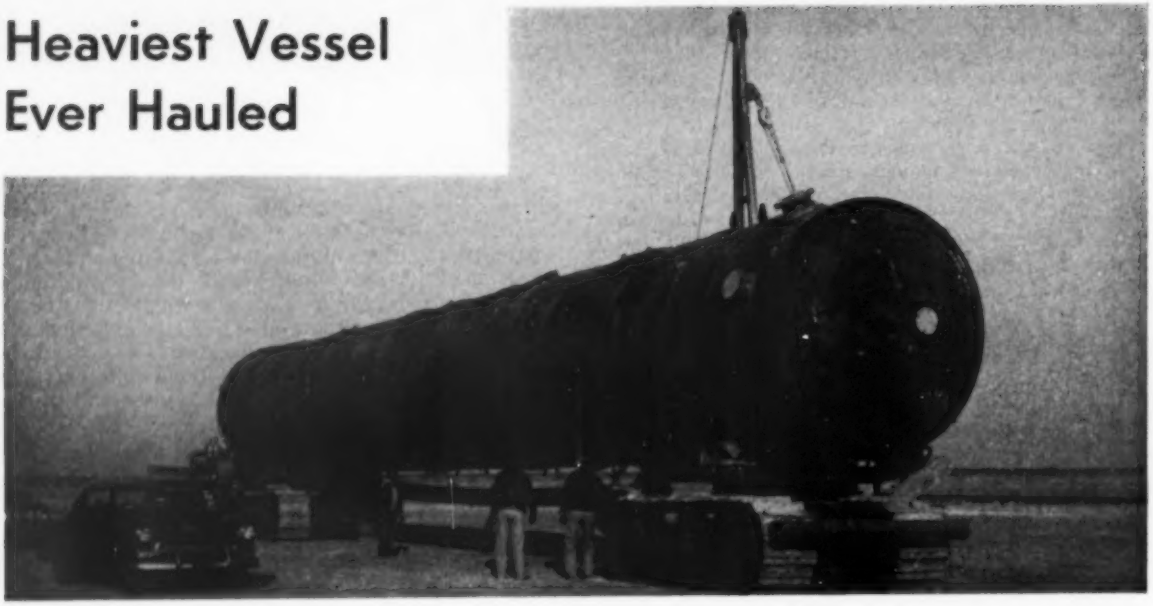
Hydroquinone

The reaction to produce hydroquinone takes place under pressure at 50 to 80 C., with iron tetracarbonyl hydride as the catalyst. The yield is 20 to 30 percent.

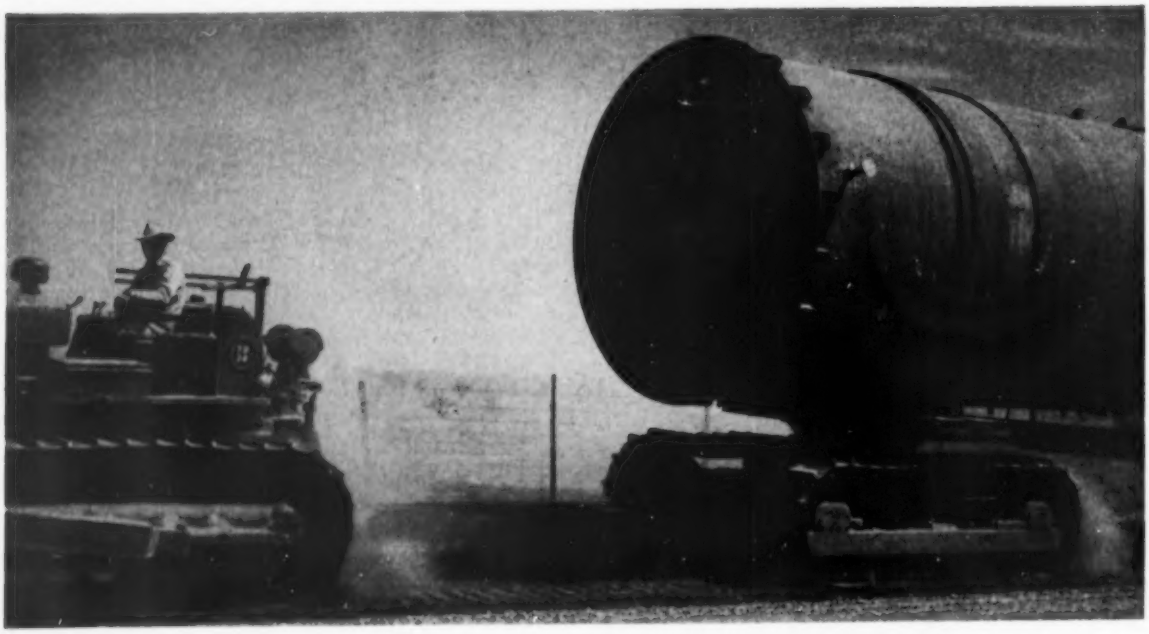
The Rohm and Haas Company (Houston), produces esters of acrylic acid by the reaction between acetylene, carbon monoxide and an alcohol at atmospheric pressure and moderate temperatures. Small amounts of nickel carbonyl are used as a catalyst, and the yields are in the range of 90 percent. # #

Editor's Note: This is the concluding part in this current series by Dr. Hatch.

Heaviest Vessel Ever Hauled



1. Start: The 30-mile haul began at Benedum railroad siding.



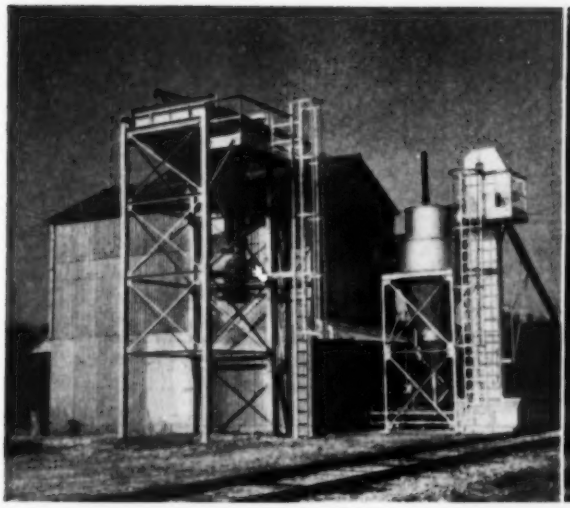
2. In the bar ditch: The vessel was too heavy to be hauled over Texas roads.

ONE OF THE HEAVIEST vessels ever hauled in one piece was moved 30 miles across West Texas recently by El Paso Natural Gas Company. To move the 77-foot de-ethanizer tower, the company designed a super aetheia wagon, and built it at the company shop near El Paso.

The problem was to move the vessel from a railroad siding at Benedum, Texas, to the company's Midkiff gasoline plant and compressor station. Since it weighed 324,000 pounds—just 265,760 pounds too much for Texas roads—the trip was made in the "bar ditch," a sandy strip beside the highway.

With two tractors pulling the load, the job was done in one day, and the vessel was erected at Midkiff several days later. The aetheia wagon has since been used by El Paso Natural to move a large absorber and propane storage tanks.

The company's Midkiff Plant is the center of its construction activity in the Permian area. All gasoline absorption, purification, and dehydration facilities from the Spraberry Trend are concentrated there. When the plant is complete, it will deliver daily about 200,000 gallons of propane, 150,000 gallons of butane, and 126,720 gallons of 12-pound gasoline at capacity operations. Start-up is scheduled for early fall. ##



Catalyst processing plant. Elevator feed hopper shown on left with reject bucket elevator and dust collector cyclone on right.

Gravity tables showing sampling procedure used for control. Cutting fingers, on edge of the gravity tables, can be moved to vary quality of the product catalyst.

New Catalyst Recovery Device

Used to recover usable Hydroformer catalysts, the cost of this novel device had a 500 percent return for the designers. Based on size-density separation, the equipment, long known in the chemical industry, finds an application in refineries.

W. E. Askey, S. W. Dedman and J. W. Smalling,
Humble Oil & Refining Company,
Baytown, Texas

SIZE AND DENSITY separation equipment, not normally associated with the petroleum industry, is being used most successfully to process hydroforming catalyst for recovery of re-useable catalyst in Humble Oil & Refining Company's Baytown, Texas, refinery. Use of such equipment and techniques, heretofore primarily used in the food industry to grade and classify seed products such as grains, peanuts and cereals, has resulted in a large reduction in operating costs at Humble's Hydroformer.

Catalyst Physical Properties Allow Separation—Hydroforming consists of passing heated naphtha vapors together with a hydrogen rich recycle stream over a catalyst. The primary reaction taking place is dehydrogenation of naphthenes, but at the high temperatures employed, undesirable side reactions occur which cause formation of polymers or coke on the catalyst. This coke reduces the active surface of a catalyst, hence its activity, and must be removed periodically. Regeneration is accomplished by passing air diluted with inert gases over the catalyst, regulating the catalyst bed temperature by control of oxygen concentration. The catalyst in use at the Baytown Hydroformer is similar to that used at other commercial hydroforming installations; it consists of an active ingredient, molybdena, on a catalyst base, alumina. In physical appearance this catalyst is a 3/8-inch pellet and when fresh has a relatively high crushing strength. Its catalytic activity may be measured by a physical property, namely surface area. When fresh and very active the surface area of the commercial catalyst may be as high as 140 square meters per gram when measured by adsorption of nitrogen at liquid nitrogen temperatures. The relationship between surface area and activity is such that there is no noticeable change in activity as long as the surface area is above 80 square meters per gram. However, the activity decreases sharply below 70 square meters per gram so that at a value of 60 the catalyst retains only 95 percent of its initial activity, and at a value of 50 it is only 85 percent as active as fresh catalyst. Figure 1 shows how the catalyst activity as measured by surface area decreases with catalyst age. The economic level of activity where replacement is feasible has been established and is represented by a surface area of 70 square meters per gram. This is equivalent to an average catalyst life of eleven months.

TABLE 1

Time at Temperature, Hours	Catalyst Surface Area Sq. Meters Per Gram		
	1200F.	1400F.	1600F.
0	140	140	140
6	140	129	38
10	139	124	23

The principal reason for catalyst deactivation is overheating. This is

shown in Table 1.

It is apparent from this table that temperatures in the neighborhood of 1600 F. sharply reduce surface area and activity. It is also apparent that there is some effect of temperature at 1400 F. and that surface area decreases as the time at this temperature is extended. Temperatures above 1000 F. do not normally occur during the reaction period. During regeneration, however, it is possible and indeed likely that temperatures above 1000 F. will be found. Normally, temperatures not exceeding 1050 F. are maintained in the catalyst bed during regeneration. However, since only gas temperatures are measured, catalyst surface temperatures are somewhat higher. In addition, if poor distribution is found in the reactor, portions of the bed may exceed these temperatures. Since thermocouple measurements can be obtained for only a small portion of the entire bed, it may be possible for one part of the bed to reach a relatively high temperature without being noticed. Should this occur, catalyst will lose surface area and become deactivated. The high temperatures will also have a deleterious effect on another physical property of the catalyst, that is, its crushing strength. Should the crushing strength be reduced to a low level, the pill will probably be broken, causing formation of catalyst dust. Catalyst dust will in turn cause plugging of the catalyst bed and result in even poorer distribution of the regeneration gases. These points of localized overheating or "hot spots" result in further deleterious effects on surrounding catalyst. Complete prevention of "hot spots" is impossible in the large fixed bed when operating at regeneration temperatures around 1050 F. They can be minimized, however, by control of oxygen content of the regeneration gas to a point which will allow a regeneration gas temperature not exceeding 1050 F. Thus, oxygen content becomes the primary regeneration control and actual gas temperature a secondary control.

Since all portions of the catalyst bed do not receive the same treatment, viz., constant time at equal temperatures, the catalyst, when removed from the reactor, contains pills of unequal catalyst activity. The majority of the pills are above 80 square meters per gram in surface area and have a reuseable life of eight or nine months. A small portion of the pills which have been subjected to overheating have a surface area of below 40 square meters per gram and are not fit for reuse. Since most of the particles are still the same size, normal separating techniques using mesh screens will not allow efficient recovery of the good catalyst for reuse. It is possible, however, to pass all of the catalyst over these screens operated by hand and partially remove dust and broken pills. Of course, dust and broken pills are the worst offenders, since they have by far the lowest surface area. The remaining catalyst has a reuseable life of four to five months. After the second use all catalyst must be disposed of.

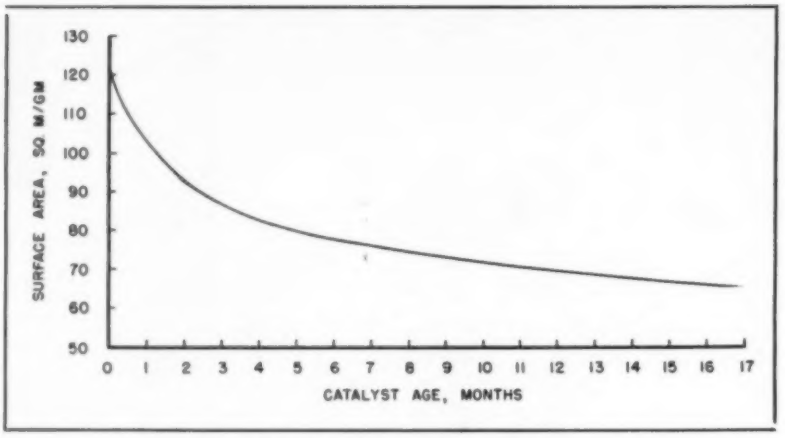


Figure 1. Decline of catalyst activity with age.

Catalyst costs represent a large portion of the controllable operating costs at the hydroformer. The potential credits available by increasing catalyst utility provided a large incentive for technical work directed toward increasing catalyst life. Improvements on the hand screen method were made. The first of these was replacement of the older equipment with a mechanically shaken screen to improve separation efficiency. This, however, was not the answer to the problem, since size separation alone could not remove the deactivated whole pills, and size separation per se was still relatively inefficient.

Physical properties of the catalysts were examined closely to determine whether some other method of separation could be used. It was found that the surface area could be correlated with the average crushing strength of the catalyst. This correlation is shown in Figure 2. Obviously, if the weaker pills could be broken and then screened out of the stronger pills, catalyst activity could be increased. This scheme was tried in a batch-wise manner by rotating the catalyst in a conventional concrete mixer. The weak pills were attrited and the remaining whole pills recovered by screening showed an increase in crushing strength from an average of about 55 to 60 pounds. This was an improvement over the screening technique alone, but the efficiency of breaking all the weak pills while not injuring strong pills was still relatively poor. Further examination of the physical properties showed that average crushing strength could be correlated with the catalyst's apparent bulk density, as shown in Fig-

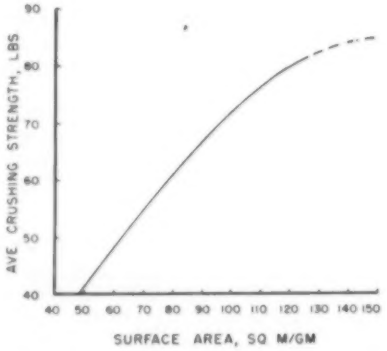


Figure 2. Relationship between catalyst crushing strength and surface area.

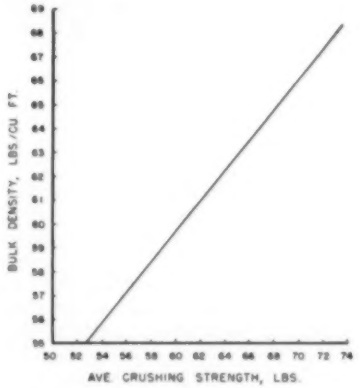


Figure 3. Relationship between catalyst bulk density and crushing strength.

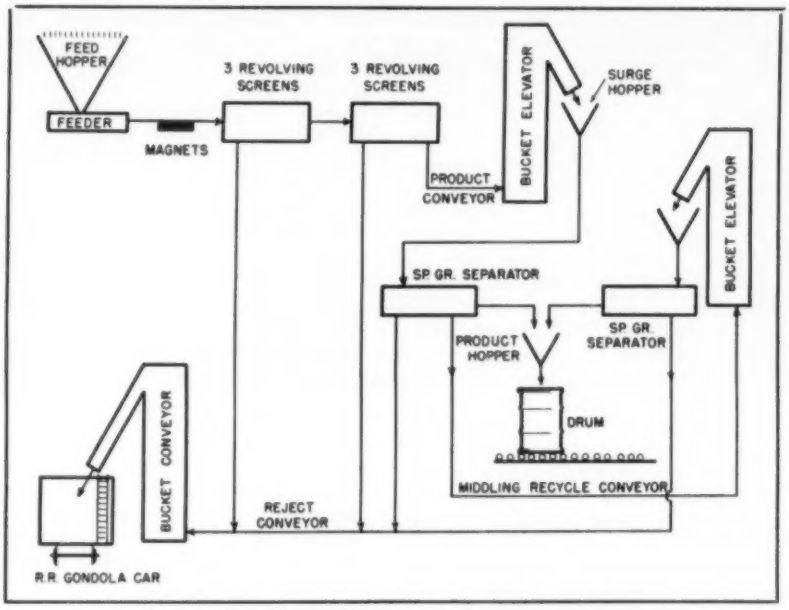


Figure 4. Flow diagram showing major pieces of equipment.

ure 3. This suggested the possibility of separating spent from reuseable catalyst by a method involving density. Since separations of this type were made in other industries, manufacturers of this type of equipment were contacted as to the possibility of its application to this particular job. Samples of catalyst were run in equipment consisting of graders for size separation and gravity tables for density separation. It was found that by proper adjustment of the equipment, practically 100 percent efficiency of removing spent from reuseable catalyst was obtained. Table 2 shows the results of these tests.

Commercial operation of the equipment since its installation in May, 1953, has parallelled the results of the initial test.

Equipment Description—Humble's catalyst processing plant is believed to be the first application of this type of equipment to catalyst separation. The primary design problem involved in its development was to take advantage of the physical differences between active and inactive catalyst by selection and integration of commercially available equipment capable of making the desired separation. This must be accomplished at a reasonable rate without damaging good catalyst and without releasing excessive quantities of catalyst dust. Humble's solution of this problem resulted in a plant capable of classifying catalyst by dimension and by weight at a feed rate of approximately 3000 pounds per hour. The classification by dimension is made to eliminate nonreuseable catalyst consisting of broken pills, dust, agglomerates, and pills reduced in size by wear. This classification by dimension also serves to eliminate foreign objects such as nails, welding rods, wood chips, bolts, insulating brick and rags. The classification by weight is made to eliminate catalyst pills that meet the size specifications that have been established but which are not suitable for reuse because of low crushing strength and reduced activity.

Figure 4 shows how individual pieces of equipment are integrated to allow automatic catalyst separation. Catalyst to be processed is loaded into an elevated feed hopper covered with a bar grate. An electronically controlled screening feeder passes catalyst through magnetic separators and three revolving screens in parallel with round hole openings sized to pass only good catalyst. A product conveyor and bucket elevator carry the catalyst to a surge hopper equipped with high and low level controls. Catalyst is fed to a specific gravity separator that is started and stopped by the surge hopper level controls. Active catalyst is collected in a product hopper, while a conveyor carries a middling product, part good and part bad, from the first specific gravity separator to a second bucket elevator. This elevator charges a second surge hopper equipped with high and low level controls which feeds a second specific gravity separator that is started and stopped by its surge hopper level controls. Active catalyst is collected in the same product hopper described above. Catalyst drums are filled manually from the product hopper and are trucked to storage.

Material not suitable for reuse is rejected from the product stream in the following order: (1) large foreign objects, relatively few in number, are collected by the bar grate on the feed hopper and are disposed of manually as necessary, (2) foreign objects large enough to stop flow through the revolving screens but small enough to pass the bar grate are collected by the screen of the feeder and are rejected automatically to the reject conveyor, (3) small metallic objects that might damage the revolving screens are separated from the catalyst stream by permanent magnets which are manually cleaned at regular intervals, (4) all material smaller than acceptable passes through the slots of the first set of revolving screens and falls into the reject conveyor, (5) all remaining material larger than acceptable is retained on the screen of the second set of revolving screens and is conveyed by the revolving motion to the end of the screens where it drops into the rejector conveyor, (6) rejects from both specific gravity separators fall into the reject conveyor, (7) the reject conveyor moves all rejects to a bucket elevator where it is lifted and allowed to drop through a swinging chute into a gondola car.

An important feature of the screening plant not yet mentioned is its dust collecting system. This system consists of a 15-hp blower, a cyclone separator and ducts that permit pulling catalyst dust from each piece of the totally enclosed equipment. The tumbling caused by the revolving screens and the rapid flow of catalyst through the various chutes tends to release dust from the pills and allows it to be drawn through the blower and discharged to the cyclone separator where it is collected with reasonable efficiency. Dust collected in the separator drops into the reject conveyor. This system removes the major portion of catalyst dust, previously discharged to the atmosphere.

TABLE 2

PROPERTY	Fresh Catalyst	After 11 Months Use	Products from Processing	Rejects from Processing
Surface Area, Sq. M./Gram	120	70	84	55
Crushing Strength, Pounds	80	55	63	45
Average Catalytic Activity, Percent of Fresh Catalyst	100	95	100	90
Predicted Catalyst Life Before Reworking, Mo.	11	0	8	0

Catalyst Recovery Device...

The specific gravity separators are probably the most important items of equipment in the plant. The catalyst to be classified by weight is caused to flow across the surface of a reciprocating deck which is covered with a porous cover through which air is blown. The catalyst is floated and stratified by air, the heavier particles settling and the lighter particles rising to the top of the bed. The motion of the deck, the volume of the air, the speed of deck oscillation and the slope of the deck all combine to cause the heavier catalyst to settle and travel further along the deck than the lighter catalyst. The heavier catalyst pills are conveyed along the deck in the direction of its motion and are discharged at its high end while the lighter pills are floated by the air and travel more or less across the line of motion of the deck and are discharged at its low end. There is a middling product discharged between the high and low ends of the separator deck and a second separator has been provided to make additional separations of this material. The middling product from the second separator can either be recycled or rejected. Cutting fingers on the edge of the separator deck may be adjusted to control qualities of product, reject and recycled catalyst.

Air blown through the separator decks not only floats the catalyst, but also blows from the pills almost all of the dust that may remain at this stage. Hoods that are connected to the dust collecting system have been provided above the vibrating decks to handle this remaining dust.

The feed rate to the screening equipment is adjusted by means of the electronically controlled screening feeder which gives control that is quite adequate. Flow between items of equipment is by gravity where practicable.

Failure of any one of the items of equipment causes an alarm to sound. This permits the operator to stop flow through the unit before the system becomes choked with catalyst. The control board contains start and stop buttons for each motor driver and an indicating light to show the location of the failure.

Catalyst Separation Operations—Prior to the start of catalyst processing, the equipment was tested with fresh catalyst to determine the amount of losses of good pills. All of the equipment was satisfactory with the exception of the second stage graders where losses of ten percent were encountered. These graders were reamed to slightly larger diameter holes and were shimmed to $\frac{3}{8}$-inch elevation at the discharge end reducing losses of good catalyst to less than 0.2 percent.

Control of the graders during actual operations is obtained by periodic sampling of the rejects from the second stage graders for checking losses and by sampling of the material in the reject conveyor to check passage of fines from the first stage graders. Realized capacity of the graders is sufficient to insure adequate separation as long as the baskets and chutes are clean. Control of the final quality of the product catalyst is obtained by sampling recovered material and measuring its bulk density. These samples are obtained by the unit operator at hourly intervals and at any other time he may feel the catalyst feed quality has changed. Additional samples are obtained on a composite basis for submission to the routine laboratories for testing of crushing strength and surface area. Changes in catalyst quality are made possible by shifting location of the cutting fingers on the discharge edge of the gravity tables. If a higher quality product is desired, the cutting fingers are shifted toward the heavy end, or if a lower quality product is desired, the cutting fingers are shifted to the light end of the gravity table. It has been found that the separation obtained from the first stage gravity table is much better than that which can be obtained from the second stage, making it necessary to operate the first stage to yield a product of higher density than the second stage in order to produce the desired quality on the combined product. As operating knowledge and techniques have improved, samples of catalyst varying less than three pounds per cubic foot in bulk density are obtainable. The difference in bulk density between product catalyst and rejects is normally in the order of ten pounds per cubic foot.

As in most operations involving new equipment or new techniques, the initial operation of this equipment presented several difficulties. The principal difficulty encountered was in the performance of the bucket elevators. It was found that catalyst hitting the elevator chutes frequently bounced past the buckets and fell to the bottom of the sealed shaft. Insufficient clearance was provided between the chute edge and the bucket, so that frequently a bucket would catch the rigid chute and cause the overload relay to kick off the motor. Catalyst from the conveyor would then dump into the bottom of the shaft along with that catalyst which had already been bypassed. Since the catalyst crushing strength was relatively high, the motor was not able to drag the buckets through the bed of catalyst on restarting. The chutes were redesigned and fabricated of sheet metal with a rubber edge. Elevator shafts were provided with a spillway to prevent accumulation of catalyst. In addition, larger motors were installed. After these changes, operation of the elevators was excellent. Other minor difficulties were encountered. It was necessary to install magnets in the feed chutes to remove small quantities of nails, wire, and scrap metal, since these metal particles lodged in the metal grader baskets. It was found that the crushed fire brick used as a supporting bed in the Hydroformer tended to pass through the graders and eventually clog the second stage graders discharge chute. The solution of this problem was periodical cleaning of the reject chutes and installation of a bar grate with smaller openings on the feed hopper along with a smaller vibrating feeder element.

With the elimination of these mechanical operating difficulties, it was possible to operate the equipment at its design capacity of 3000 pounds per hour. Continuous catalyst flow through the system is provided by adjustment of the feed rate to the graders according to catalyst inventory after the graders and ahead of the gravity separators. The feed rate to the first and second stage gravity separators is controlled so that the second stage gravity separator hopper holds an inventory ahead of the second stage. Thus, the second stage grader is operated continuously rather than intermittently, maintaining constant catalyst composition. Adjustments of products from both separators is possible by relocation of the cutting fingers according to the bulk density measured after the product sampling.

More than 750 tons of hydroforming catalyst was processed in the first six weeks of operations. This included catalyst of widely varying quality. Some of the catalyst had been used twice in the unit prior to processing and was unfit for reuse. It normally would have been disposed of since its average surface area was approximately 50 square meters per gram. About 75 percent of the total catalyst charged was recovered with an average surface area of 85 square meters per gram. Increased value of the recovered catalyst is more than five times the original cost of the equipment. In addition, continued use of the equipment will reduce hydroforming operating costs considerably by reductions in fresh catalyst purchases. Utilization of the equipment for separation of other types of catalyst used at Baytown is under consideration. ##

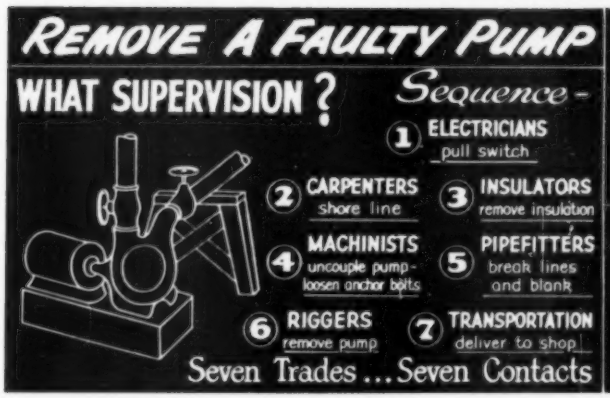

REMOVE A FAULTY PUMP
WHAT SUPERVISION ?
Sequence -
1 ELECTRICIANS pull switch
2 CARPENTERS shore line
3 INSULATORS remove insulation
4 MACHINISTS uncouple pump - loosen anchor bolts
5 PIPEFITTERS break lines and blank
6 RIGGERS remove pump
7 TRANSPORTATION deliver to shop
Seven Trades ... Seven Contacts

Figure 1. Contacts required to remove a faulty pump.

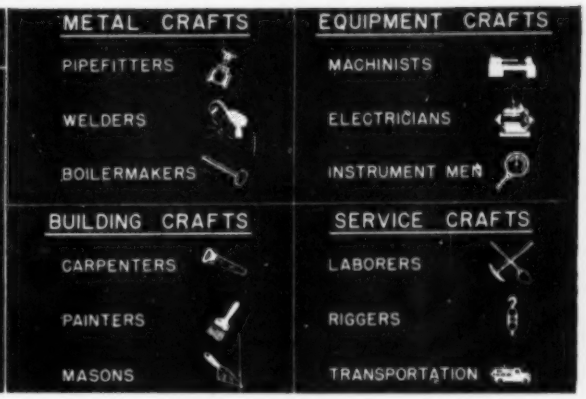


Figure 2. Leading mechanical crafts.

Maintenance Reorganization Pays Off

Improvements of 12-20 percent achieved through more efficient utilization of men, tools and materials.

E. C. Hermann,
Esso Standard Oil Company,
Bayway, N. J.

PROBABLY ONE of the most basic and yet most vexing objectives to reach in refinery maintenance today is the optimum utilization of men, materials and tools. A widely varying work load requiring the use of many crafts and a variety of materials and tools constitutes a real challenge to maintenance managers. Today, in many large petroleum refineries even the simplest routine maintenance jobs can become a major problem in co-ordination. As an example, let us consider a pump repair job (Figure 1).

After notification from operating personnel, the field engineer notifies the lead craft supervisor; e.g., the machinist foreman. The machinist foreman, in turn, may require the assistance of electricians, riggers and pipefitters, and even carpenters and insulators. If shop work is involved, several more contacts must be made. Not infrequently, the lead supervisor's communicating time will exceed the actual time required to effect the repair. Operating personnel, whose persistent demand for service is equalled only by their requests for new installations, often times make their requests directly to the mechanical supervisor involved, in an overzealous effort to expedite the job. Clearly understandable, this practice may accomplish the objective but often at the expense of more critical emergency repairs since some operating people find it difficult to recognize the over-all needs of their plant. Similarly, the overwilling craftsman may undertake a project only to find supporting crafts or critical materials unavailable.

Areas may develop within a plant where operating and mechanical personnel have mutually developed practices and methods peculiar to the equipment and machinery involved. Here they develop their own special storehouse, their own techniques of communication and mechanical practices. All goes well until a lead supervisor dies or retires, taking with him the secrets of the craft. The result is often confusion and the impression is created that perhaps some employes are indispensable. Effective as these arrangements appear, they are apt to stagnate rather than improve mechanical efficiency. One answer has been the standardization of practices and methods throughout the plant.

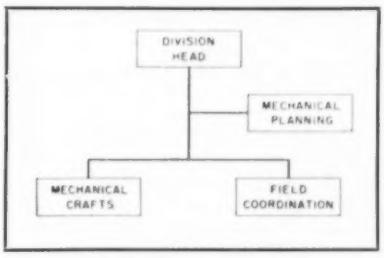


Figure 3. Maintenance organization.

The Problem—A large plant today may have as many as fifteen separate and distinct crafts within its mechanical group, with as many as four classifications in each craft (Figure 2). Unless adequate provision is made to relieve the craft foremen of some detail work such as co-ordinating supporting crafts, expediting materials and timekeeping, such important functions as craft training of apprentices may be left up to the individual first-class mechanic. A preventive maintenance program is almost sure to run a poor second to the day-to-day "must go" jobs if these jobs are accompanied by a multitude of detail for the craft foremen to attend to. Probably the most reliable symptom of a deficiency in field co-ordination and expediting is a request for additional mechanical wage earners and an unbalanced craft distribution; e.g., the ratio of pipefitters to welders or riggers, etc. Manning certain crafts for peak demands is extremely expensive, particularly when full utilization of such man-

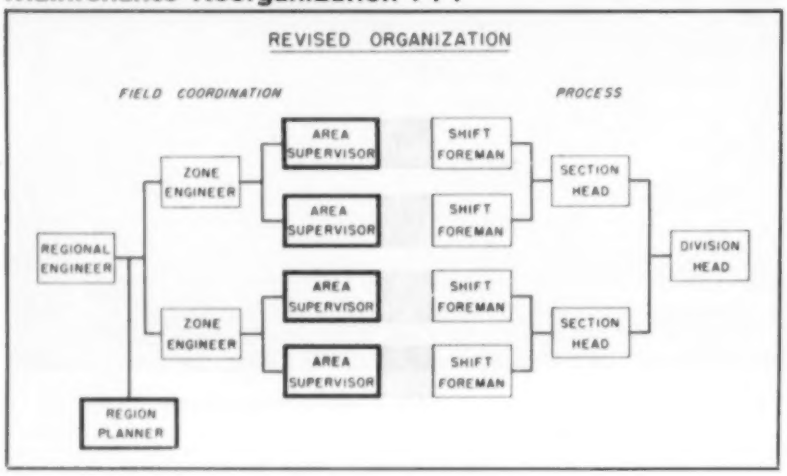


Figure 4. Functional alignment.

power is infrequent.

Organizational Objectives—It becomes readily apparent that a good petroleum-refinery maintenance organization must include in its structure the following characteristics:

(a) Well-defined assignment of authority and responsibility.
(b) Effective co-ordination (men, materials, tools). Good communications.
(c) Standardization of methods.
(d) Workable preventive maintenance programs.
(e) Craft training of mechanics. Good sound personnel administration.

A close study was made of the existing organization and tentative changes were prepared, designed toward establishing a maintenance organization which would meet the requirements for efficient mechanical work. The innovations are not original or new with the industry; however, the method used to accomplish the transition to meet the objectives and the results achieved are all worthy of study.

Original Organization—The original maintenance organization consisted of three sections; Mechanical Crafts, Field Co-ordination, and Mechanical Planning (Figure 3).

Mechanical Crafts. Each craft group was headed by a general foreman, with two or more zone foremen, each of whom directed the efforts of several first-line foremen. The major function of the Mechanical Crafts section was to provide trained manpower and the work direction required to perform any mechanical work. Assignment of manpower was under guidance of Field-Co-ordination section engineer.

Field Co-ordination Section. The plant was divided into four geographical regions each having a regional engineer with two assistants or zone engineers. It was the responsibility of this Field Co-ordination section to co-ordinate the daily mechanical work, plan weekly assignments of manpower, and develop better work technique and preventive maintenance programs. While the Field Co-ordination section was fairly closely aligned with the process organization, the two groups were not completely parallel owing to a recent rapid increase in the size and complexity of the process operations without a corresponding increase in the Field Co-ordination section. The absence of a direct-line relationship between the Mechanical Crafts section and the Field Co-ordination section was the most serious deficiency.

Mechanical Planning Section. Mechanical Planning was charged with the responsibility of preparing long-range and intermediate-range work plans, extended period manpower assignment schedules, and predicting required adjustments to the craft balance. This section, operating in a staff capacity, performed many additional studies and analyses related to mechanical activities.

There was considerable overlap of responsibilities between the three sections, particularly in matters of moving manpower, expediting jobs, ordering material and assigning industrial equipment. This led to confusion and created added problems in co-ordinating the work effort among a number of the crafts, particularly the lead crafts. Solution of the co-ordinating problems associated with the day-to-day jobs left the supervisors with insufficient time for any longer range needs such as craft training or improved work methods and programs.

Recognition of the deficiencies in the original maintenance organization led to a careful functional analysis of the components of the maintenance organization and a detailed study of the organizational structure of other industrial plants having comparable maintenance requirements.

FIGURE 5
Check List of Authority and Responsibility

Authority and Responsibility	Craft F'man	Area Super.	Gen. F'man	Reg. Engr.
Personnel Problems	(X)		X	
Communications	X	X	X	X
Individual Job Performance	(X)		X	
Scheduling Work		X		X
Placement of Men		(X)		X
Establishing Job Priorities		X		(X)

(X) Indicates primary responsibility.

Model Organization—The organizational structure chosen as a model was selected on the basis of its ability to relieve the recognized deficiencies and at the same time be capable of fitting into the over-all organization of the plant in question.

It was decided that the conversion from existing organization to the adopted model organization would best be done in one move, while preparations to meet the objectives of the conversion would be handled stepwise.

The first step was to redivide the plant into physical areas which would be in close alignment with the process organization, while emphasis was placed upon this alignment between maintenance areas and process organization. Consideration was also given to the following:

(a) The physical size of the area.
(b) The complexity of equipment within the area.
(c) The number of mechanics required for routine maintenance in the area.

The second step was to establish the new position of area supervisor for each individual area. This area supervisor, whose counterpart in the process operation is the process supervisor, was to devote full time to the field co-ordination of mechanical work within his area, with full authority to give work assignments to the mechanics of all crafts working in his area on routine maintenance (Figure 4).

By establishing this new position, the zone engineer and craft foremen were relieved of the highly time-consuming responsibility of assigning manpower to jobs, job pushing, and in general maintaining all process equipment in good operating condition.

A careful check of the daily activities of each craft foreman indicated that approximately 16 percent of their number could be transferred to the new position of area supervisor. The remaining craft foremen, relieved of such co-ordinating duties as manpower

assignment to jobs, job pushing, etc., not only could supervise a larger group of mechanics but also devote full time to their primary responsibility of work direction, craft training, and personnel administration. The craft foreman was to assign men to the area supervisor who would in turn allocate them to jobs within his area.

Since the job co-ordination and pushing had been done by the zone engineers as well as the craft foremen, the institution of the area supervisor position would make the zone engineer available for more field engineering and planning work. One zone engineer from each region was designated as "region planner" and assigned full time to work planning. It would be the responsibility of this engineer to work closely with the zone engineers in his region and the other region planners to set forth practical and efficient mechanical work plans. The need for such specific planning was emphasized by the assignment of supervisory functions to two groups—the craft foremen and area supervisors.

The close communication required for detailed planning and co-ordination between the maintenance organization and the process organization was enhanced by the previously mentioned realignment of the Field Co-ordination section to parallel the process organization. The area supervisors, zone engineer and regional engineer with their respective process counterparts, of unit foreman or shift foreman, section head and process division head provided a mutual contact in related responsibilities at each level of both organizations.

The area supervisor was to be housed within his assigned area, preferably in an existing control house or operating plant building in order to provide a single personal contact to supply the "on the spot" service needs of the process operators. His manpower requests would be directed to his region planner. Selection and assignment of mechanics to areas, based upon daily planning direction from the region planners, would be done by each craft foreman.

Redistribution of Responsibility—The organizational structure outlined emphasized the need for a complete functional analysis for the supervisory groups involved. However, to meet the initial requirements, a check list of authority and responsibility was prepared listing the major supervisory functions assigned to each first-line foreman, general foreman, regional engineer and area supervisor (Figure 5).

Of necessity, the check list could show only the major functions. Specific details in the form of a comprehensive, well-defined functional analysis would have to follow shortly after reorganization to make all supervisory positions clear-cut. The check list would provide a most important initial over-all indication for all supervisors involved, of the change in scope of jobs. The functional analysis prepared is elaborated upon later.

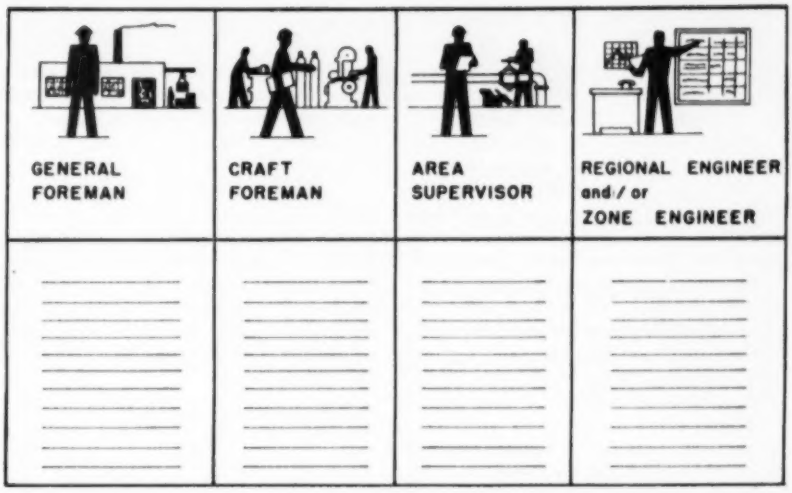


Figure 6. Functional analysis.

Preparation for Changes—Having once decided upon the basic changes in principle, it became necessary to "sell the plan" to the supervisors involved and impress upon them their responsibilities, individually and collectively, for making it a success.

The regional engineers and general foremen were brought together in out-of-plant meetings for a detailed review of the problems and the submission of a rough draft of the organizational proposal including the check list of authority and responsibility. Their severest criticism and suggestions were solicited to develop all workable details for the new setup. These meetings proved to be extremely fruitful and the sound practical thinking of both groups was incorporated in the over-all plan. The concentrated work of this group extended beyond the point of making refinements to the plan, it included the actual selections of candidates for positions of area supervisors. Candidates were selected on the basis of ability and background related to the area involved. For example, an electrical foreman as area supervisor for the power plant area, an instrument foreman as area supervisor for an area encompassing complex operating units, a boilermaker foreman as area supervisor for tank field area, etc.

After a thorough scrutiny by the mixed group, the plan was documented into a reorganization manual that listed all changes, the check list of authority and responsibility, the job description sheets for each position and the operating facilities to be included in each new plant area.

Adoption of Plan—A communication of the plan to all plant personnel was the next major undertaking. All supervisory personnel (in meetings of 20 or less) were presented with the outline of the plan, its objectives and how mechanical services were to be processed. At these conferences no mention was made of the identities of the new area supervisors or region planners in order to keep everyone alert to determine "who does what" and to solicit more ideas for incorporation. A similar meeting and discussion period was held with the union officers and representatives outlining in considerable detail all factors related to their interests.

After three months of development, refinement and training, personnel in the plant were considered to be ready for the adoption of the new maintenance organization. Candidates for the new positions were interviewed individually, and carefully chosen.

Thus groomed, the final phase was to acquaint all personnel, particularly the wage-earner group, with the new organization, since the mechanics would be working directly for and with the area supervisors in performing job assignments. Their relationship with the area supervisor and the craft foreman had to be spelled out clearly to prevent serious misunderstandings. A 15-page illustrated cartoon booklet entitled, "Who's the New Guy in the Picture" was prepared to explain what the new system was intended to do and how it would apply

to each wage earner. This was distributed to plant personnel several days in advance of conversion date.

Office facilities were provided for each area supervisor within his assigned area, either in an existing control house or in an operating plant building. The region planners developed the planning forms manpower assignment sheets, and duplicating facilities necessary to explain fully mechanical work-planning procedures.

On June 1, 1953, the new maintenance organization went into effect. The relative smoothness of the transition precluded the need for post reorganization meetings that originally had been considered for discussing and resolving problems. Some anticipated minor misunderstandings and misinterpretations of the new functions did occur, and required some attention. In some cases the craft foremen were concerned about the reassignment of some of their authority and responsibility; however, most of the foremen immediately took advantage of the opportunity provided by the reorganization to concentrate on their primary duties—administration and training.

Functional Analysis—Experience confirmed that in an organizational structure based upon the reassignment of supervisory functions there is an inherent need for a comprehensive and clear-cut designation of functions and responsibility. No system can tolerate unassigned or overlapping responsibilities. After three months of operating under the new system sufficient experience had been gathered to start the preparation of a detailed functional analysis covering the reassigned duties and responsibilities known or anticipated for each supervisory position in the maintenance organization.

Two pilot groups each consisting of a craft foreman, an area supervisor, a zone engineer and a training foreman were formed and the discussional technique was employed to gather information. The development period required six months for completion, with results culminated in a 200-page loose leaf manual to be used as a reference by all mechanical supervisors. Functions and responsibilities were grouped according to their relation to people, work planning and manpower allocation, work direction, tools and equipment and supplies and materials (Figure 6).

Results—Nine months after adoption, definite changes in mechanical work performance were seen. All indications were that the over-all mechanical work efficiency had increased in the order of 20 percent. Operating personnel indicated that the area supervisor was the readily available service man they had always needed. Improvement in mechanical efficiency was reflected in improved maintenance performance with a corresponding decrease in the number of manhours required for maintenance work (Figures 7 and 8).

While the over-all results of the reorganization did bring about a general increase in efficiency, there were several unanticipated adjustments that required immediate attention. Several of the areas turned out to be far too large for the area supervisor to handle properly. This was particularly true in the tank field area.

The mechanical work performed in each of the several maintenance shops being centralized and of a highly specialized nature, as contrasted with field work, represented a special case for area supervision. Here the area supervisor was instructed to work through the shop craft foreman rather than deal directly with the individual mechanic to administer planning, scheduling and expediting of shop work.

A third refinement was the establishment of a rotational plan between qualified craft supervisors and area supervisors. Under this arrangement various craft foremen are selected from time to time to replace area supervisors on vacation, or absent due to sickness. This provides the craft foremen with an opportunity to learn of the problems associated with area supervision and to have a better understanding of its function.

Additional development work will be required to apply the new system more productively to large projects and maintenance jobs such as turning around a cat-cracking unit. Study is continuing for these infrequent and short-duration peak-load jobs.

Conclusion—In conclusion, it can be stated that the redistribution of supervisory functions proved to be extremely effective, particularly in the small maintenance jobs which represent more than 50 percent of our work. Besides increasing the individual mechanic's productivity, it tends to promote to a great extent the efficient co-ordination of supporting crafts.

The organization outlined lends itself to good mechanical work planning since it provides enforcement and results at the level of the job itself.

Most interesting of all is the fact that the adaptability and flexibility of the individuals involved was greatly underestimated. Within a matter of weeks, newly appointed planners and area supervisors were discussing constructively the methods and systems to be applied under the new system and were advocating further refinements improvements.

Original presentation was before the Ninth Annual Petroleum-Mechanical Engineering Conference, American Society of Mechanical Engineers, September, 1954, Los Angeles. ##

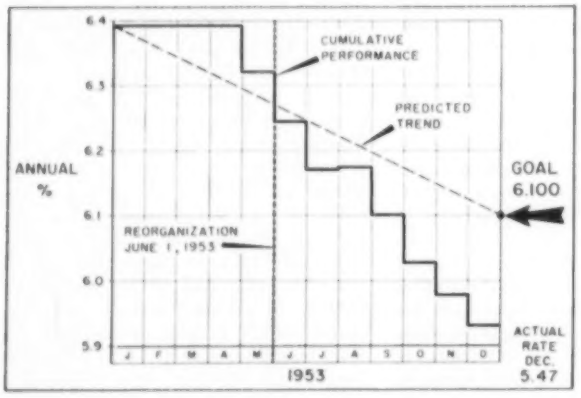


Figure 7. Maintenance labor costs as percent of plant investment.

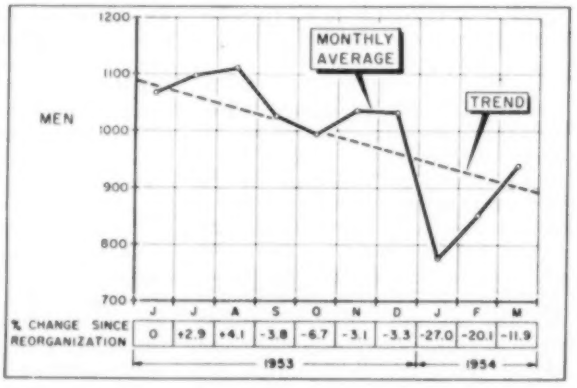
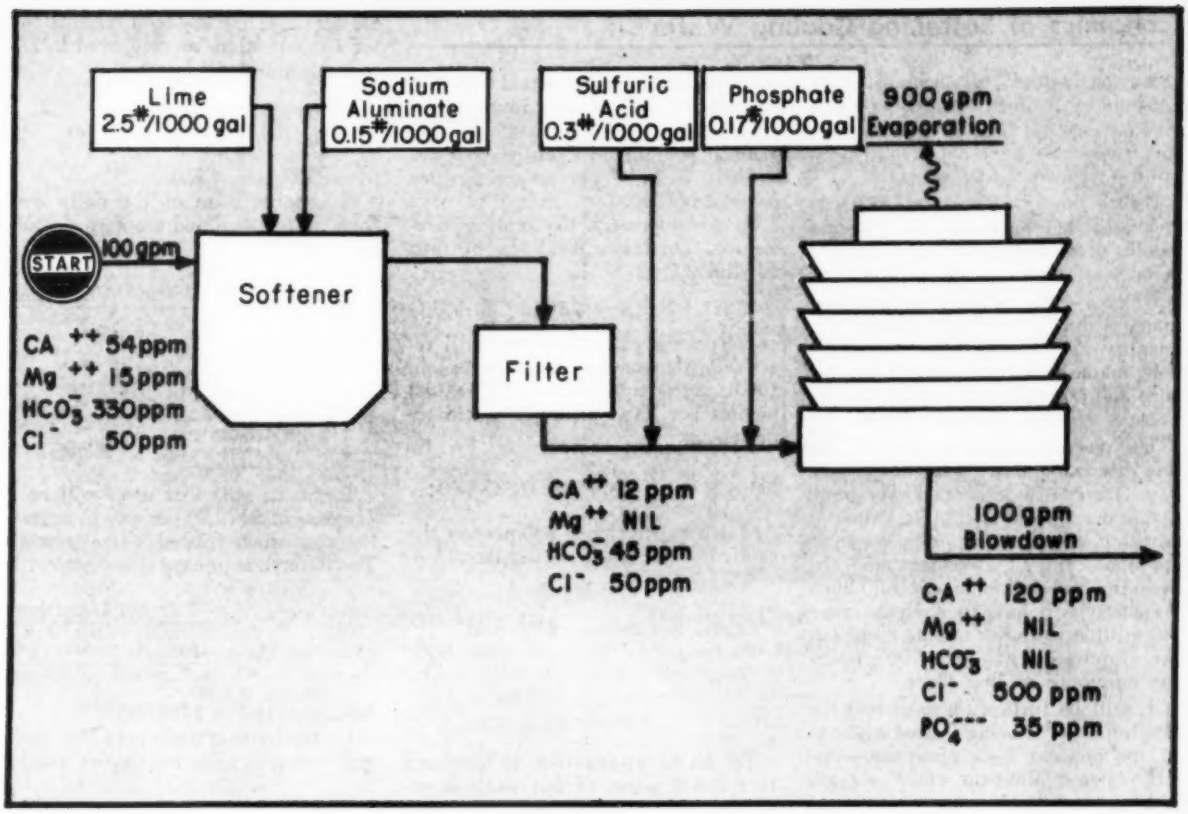


Figure 8. Men on routine maintenance since reorganization.



Schematic diagram for a water softening system illustrates the problem of a 75,000-barrel-per-day refinery.

Economics of Softening Cooling Water

Complete treating and softening of all cooling water has a payout of less than four years, plus numerous intangible advantages.

Maxey Brooke, Box 379
Old Ocean, Texas

DURING WORLD WAR I, a large industrial plant on the Gulf Coast had three complete boiler houses—one on stream, one standing by and one being cleaned. A labor gang of 60 men was kept busy cleaning boilers and water lines to enable the plant to stay on stream. No treatment was used in those days and the average on-stream time for a boiler was two to three weeks. Later, during the '20's, internal treatment allowed them to operate for as long as two months between cleanings. Some modern boilers, operating on softened water and internal treatment never need cleaning. They are opened annually for inspection only.

Let it be understood that these improvements were not put into use as they were developed. It took power plant operators nearly 35 years to be convinced that boiler water treatment which had been in existence for that long a time was economically desirable.

Except for the temperatures involved, a cooling system works on nearly the same principle as a steam system. The steam system carries heat *to* the plant by means of evaporation of water while a cooling system carries heat *from* the plant.

For years, refiners operated their cooling systems on raw water and accepted the attendent scaling and corrosion as part of normal plant operation.

More recently, progressive refiners have gone to internal treatment of cooling water in somewhat the same spirit as the power plant operators of the early '30's. Almost without exception, they have found that such treatment has paid dividends in the form of lower maintenance costs and longer

unit runs between turnarounds. It is inevitable that operators must take the final step, as did the power plant men, and begin using externally treated cooling water in the near future.

Before they do take this final step they must be convinced that the economics of softening cooling water are favorable.

Of course the situation for each refinery is different, depending upon the quantity and quality of water available, manufacturing schedules, etc. No hard and fast rule can be made but an average situation can be analyzed.

The average situation chosen for this discussion is a 75,000-barrel-per-day refinery with integrated operations —topping and vacuum units, catalytic cracking, alkylation or polymerization for light ends, LPG recovery and visbreaking for residuum control. Such a refinery will have to dissipate some 7.5 million Btu's per minute requiring the evaporation of about 900 gallons per minute of cooling water.

It will be further assumed that the cooling water is being treated with one of the popular high phosphate—low pH systems. Make-up water is available in reasonable quantities from wells with a 100-foot sand capable of producing 500 gpm per well of water with the following analysis:

Calcium	54 ppm
Magnesium	15 ppm
Bicarbonates	330 ppm
Chlorides	50 ppm

It will cost $11,000 to drill and equip a well and pumping costs will be $0.015 per 1000 gallons. The limiting concentrations in the cooling water are 375 ppm total hardness or 500 ppm chlorides.

Under these conditions, the hardness is the limiting factor and the cooling water can be concentrated only 2.5 times. The make-up water can be calculated by the formula:

$$\frac{\text{Evaporation} + \text{Blowdown}}{\text{Blowdown}} = \text{Concentrations}$$

$$\frac{900 + \text{Blowdown}}{\text{Blowdown}} = 2.5$$

$$\text{Blowdown} = 600 \text{ gpm}$$

$$\text{Make-up} = \text{Evaporation} + \text{Blowdown} = 1500 \text{ gpm}$$

The capital investment for such a water supply will be $33,000 for three wells, the pumping cost will be $1.5 \times 1{,}440 \times 0.015 = \$32.40$ per day.

It has been found by actual tests that in order to maintain a 35-ppm phosphate residual in such a system, 1500 pounds per day of chemical are needed. At $0.20 per pound, the per day cost is $300.

By stoichiometry, the acid requirement to neutralize the bicarbonate alkylinity is:

$$\tfrac{1}{2}H_2SO_4 + HCO_3 \rightarrow \tfrac{1}{2}SO_4 + CO_2 + H_2O$$

or 49 pounds of sulfuric acid will react with 61 pounds of bicarbonate ion. 1500 gpm is equivalent to 18,000,000 pounds per day, making the acid requirement.

$$330 \times 18 \times \frac{49}{61} = 4769 \text{ lbs. } H_2SO_4 \text{ per day}$$

At a delivered price of $20 per ton, the acid cost will be $47.69 per day.

To recapitulate:

Capital investment	$33,000.00	
Pumping Cost		32.40/day
Chemicals:		
Phosphate	300.00	
Sulfuric Acid	47.69	

By actual operation, it has been found that water of this analysis requires 2.5 pounds of lime per 1000 gallons and 0.15 pounds of sodium aluminate per 1000 gallons to give an analysis of:

Calcium	12 ppm
Magnesium	nil
Bicarbonate	45
Chlorides	50

It will be seen that the chlorides limit the number of concentration cycles to 10. Applying the make-up formula, it develops that the make-up will be 1000 gpm.

The capital investment for this make-up water will be two wells at $11,000 each and a water softener plant which will be about $250,000 for a total of $272,000.

The labor cost for a water softener has been found to be $0.06 per 1000 gallons which will amount to $87 per day. The pumping cost will be $1 \times 1440 \times 0.015 = \$21.60$ per day.

The chemical cost of softening will be 3600 pounds per day lime at $15 per ton or $27 per day; 215 pounds per day sodium aluminate at $0.09 per pound or $19.25 per day. The sulfuric acid requirement calculated as before is

$$45 \times 12 \times \frac{49}{61} = 435 \text{ lbs. per day}$$

for a daily cost of $4.35.

The phosphate requirement is directly proportional to the amount of blowdown. Thus the requirements for ten concentrations as compared to 2.5 concentrations will be

$$\frac{100}{600} \times 1500 = 250 \text{ lbs. per day}$$

for a daily cost of $50.

A recapitulation of the daily cost for both softened and unsoftened cooling water is:

	Softened	Unsoftened
Pumping	$ 21.60	$ 32.40
Labor	87.00	
Chemicals:		
Lime	27.00	
Sodium Aluminate	19.25	
Phosphate	50.00	300.00
Sulfuric Acid	4.35	47.69
	$211.20	$380.09

It can be seen that there will be a decrease of $170.89 per day in operating cost when treated water is used. The difference in capital investment is

	Softened	Unsoftened
Wells	$ 22,000.00	$33,000.00
Treating Plant	250,000.00	
	$272,000.00	$33,000.00

for a total cost of $239,000.

On the basis of savings in chemicals and operating cost, the payout will be

$$\frac{239{,}000}{170.89} = 1399 \text{ days or } 3.83 \text{ years}$$

which is attractive.

This, however, does not tell the whole story. The rest is difficult to evaluate, but some examples can be given:

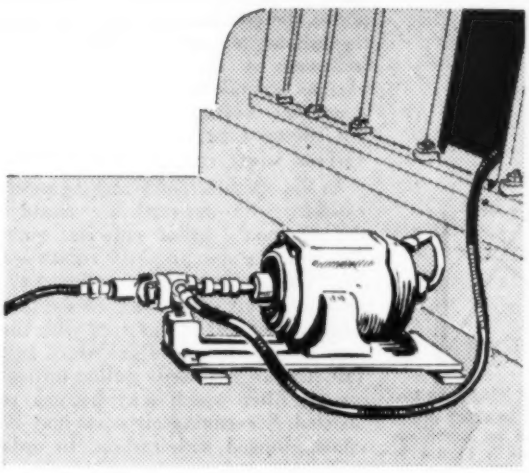
The hypothetical refinery will have at least 200 water-cooled heat exchangers. Using unsoftened water, these should be acidized once a year at a cost of about $250 per exchanger. The use of softened water could cut this figure in half, saving $25,000 per year.

If the use of softened water reduced the plant maintenance cost by as little as one percent, the daily saving would be at least $100. And if the use of softened water decreased the annual downtime by one day, it would mean that an additional 75,000 barrels of crude could be run at no extra operational expense. At $0.25 per barrel incremental value, the additional profit would be $18,750 per year.

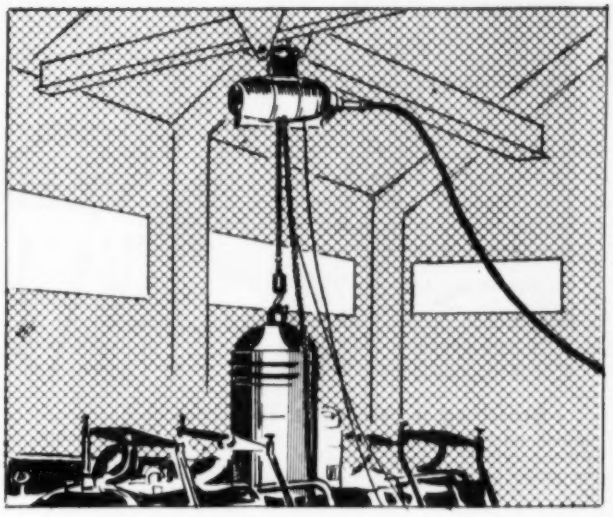
Other intangible benefits such as improved heat transfer coefficients and decreased product loss as a result of cleaner exchangers cannot be evaluated in terms of dollars and cents.

In summation, these calculations indicate that softening of cooling water may not be just economically desirable but in many cases can become an economic necessity. ##

Improve Overhauls by . . .



. . . Pumping Oil From Crankcase with a Portable Pump. The motor is explosion proof and the pump is gear type. The oil can be stored in barrels. **This is Figure 1.**



. . . Using a One-Ton Air Hoist throughout the job. This hoist can be hooked to the overhead crane which is more or less standard in every compressor building. **This is Figure 2.**

How to Maintain Compressors

This plant operator has reduced downtimes on the power end of compressors from 4.7 to 1 percent. Here are the details on exactly how he did it.

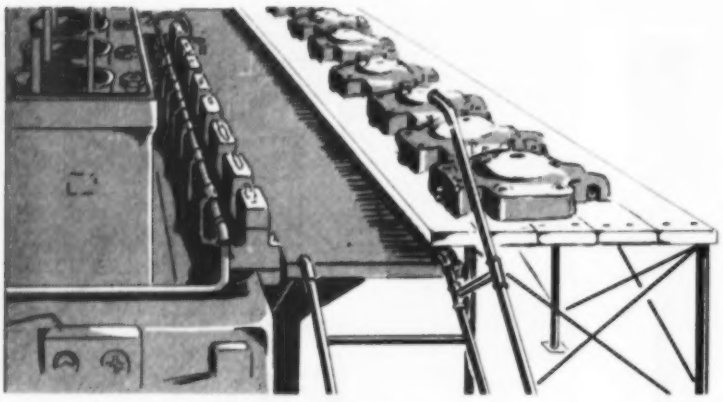
Errol R. Wagner,
Stanolind Oil and Gas Company,
Odessa, Texas.

THE POWER END of a gas engine driven compressor can be kept in good mechanical condition with 1 percent or less downtime. This can be done on a 1600-hp eight-cylinder engine with 50 or less man hours of labor per month which include inspection, minor repairs and overhauls.

The gasoline plant operator or owner usually spends a large sum of money for compressor capacity when building a gasoline plant. In a plant with a capacity of 50 Mmcf per day designed to compress low pressure gas from 5 pounds gage to 700 pounds gage, the investment for compressors will be about $3.5 million. This represents an investment of about $70,000 per Mmcf per day of gas handling capacity. In a plant of this size, ten compressors each having a gas handling capacity of about 5 Mmcf per day would normally be installed. The investment would then be $350,000 per unit. Assuming that this plant is extracting three gallons per Mcf, the gross income per compressor, including residue gas sales, would be approximately $1000 per day or about $42 per hour. This may appear to be an unusually large income; however, it should be pointed out that actually the gasoline plant owner is operating on a small margin of profit.

In a plant having a capacity of 50 Mmcf per day, it may be necessary to process 35 to 40 Mmcf per day to pay the operating expense and retire the plant investment in 20 years. If this is true, 5 percent compressor downtime or loss in gas handling capacity could reduce profits as much as 25 percent on a plant that could operate at capacity. From this it is quite apparent that where a plant is operating at full capacity, downtime is quite costly. This loss in revenue is one very good reason why the plant operating personnel should develop a maintenance program which will hold compressor downtime to a minimum. Such a program was used to reduce downtime from 4.7 to 1.04 percent in a compressor station having ten 1600-

Improve Overhauls by . . .



. . . Building a Portable Scaffold four feet wide and the length of the catwalk on the engine. When time for overhaul comes, it can be erected in short order and the cylinder heads and other parts dismantled from the engine can be stored on the platform, eliminating the need for lowering them to the floor. **This is Figure 3.**

hp, eight-cylinder, two-cycle engines. The procedure advocated to accomplish this will be presented under: (1) Preventive Maintenance, (2) Repair and Overhaul of Engines, and (3) Material Selection and Life.

Preventive Maintenance—Preventive maintenance will be defined as minor work that can be done between overhaul periods which will minimize unit downtime and over-all maintenance and operating expense.

The practices brought out in this paper will apply to most two-cycle engines. Preventive maintenance on the power cylinders is probably the most important and will be discussed first.

The ignition system is the heart of an engine. It should be kept in as near perfect condition as possible at all times. Magnetos should be reconditioned in a reputable magneto shop at least once each year, preferably every six months. Coils should also be checked in a reputable magneto shop every year. Spark plugs should be removed from each engine and replaced with reconditioned tested plugs periodically. The period of operation between change outs will depend on the type plug used and the operating conditions. Certain plugs can be operated ten weeks or more and give good engine performance. Magneto or ignition timing should be set as accurately as possible to give best results. A timing light used to check ignition timing on automotive equipment is ideal for this purpose and should be used. If the above procedure is used, very little ignition difficulty will be experienced.

On a two-cycle gas engine, air is used for scavenging or removing the burned charge from the power cylinder and providing air for the combustion of fuel. The volume of air remaining in the cylinder for combustion is relatively constant regardless of the load on the engine. The fuel is admitted to the cylinder through a fuel injection valve which opens a fixed distance. The amount of fuel entering the cylinder is controlled by the fuel pressure on the fuel manifold which in turn is controlled by the main fuel valve operated by the governor. As the load increases on the engine, the governor opens the main fuel valve farther, causing a higher pressure on the fuel manifold which in turn forces more fuel into the cylinder through the fixed opening of the fuel valve.

When the engine is first placed in operation, an engine indicator is used in conjunction with the pyrometers on the engine to adjust the fuel and air to the individual cylinders, balancing the load so that each cylinder develops the same horsepower for any given load. When the engine is properly balanced by this method, the pyrometer reading will be approximately the same on each cylinder for any given load. Since the air charge in the cylinder does not vary with the load, the cylinder exhaust temperature is used, in effect, to determine the ratio of the air and fuel burned in the cylinder. The more fuel burned in the fixed volume of air, the higher the temperature. After the engine has been balanced with the indicator as outlined above, the common practice is to keep the exhaust temperatures balanced as indicated by the pyrometer on the various cylinders. This theoretically keeps the horsepower developed by the engine evenly distributed to the various power cylinders.

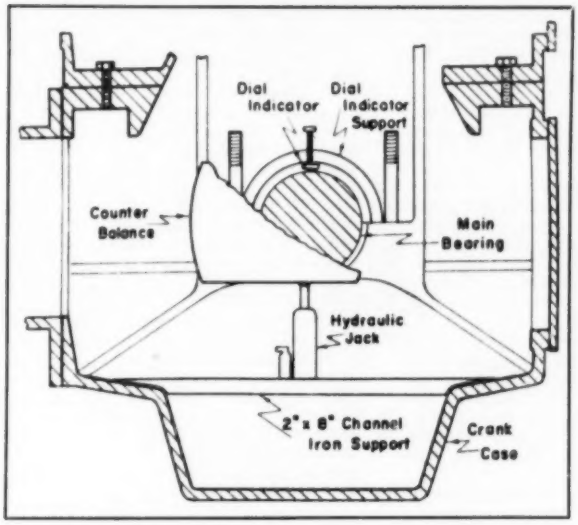
In the operation of filling the power cylinder with an explosive mixture, the air should be of sufficient quantity, and the gas properly controlled. The air is normally supplied by a scavenging air compressor on the unit. This compressor is equipped with suction and discharge valves which may fail. The air is usually pulled through an air filter which may become restricted. Scavenging air ports may become plugged with carbon. In order to prevent maintenance resulting from a shortage of air due to any of these three possible causes, it is desirable to install a mercury manometer on the discharge of the scavenging air compressor on each engine. A high pressure will indicate carbon in the power cylinder ports, while low air pressures will indicate a failure in the scavenger air compressor or air filter. This pressure should be recorded approximately once each shift so that normal pressure can be established and unusual conditions observed.

As an aid in checking the performance of the engine, it is also advocated that a mercury manometer be installed on each engine and connected downstream from the governor fuel valve. The operators will soon learn to associate this fuel pressure with the gas load being handled and the manometer will give a visual means of determining whether the fuel valves are generally set at the proper clearance. Excessive clearance on all the fuel valves on an engine will result in a high fuel pressure and may reach the point where the unit will not handle the gas load at the rated speed. Excessive valve clearance also causes excessive pounding on the fuel injection valve and seat resulting in decreased valve life.

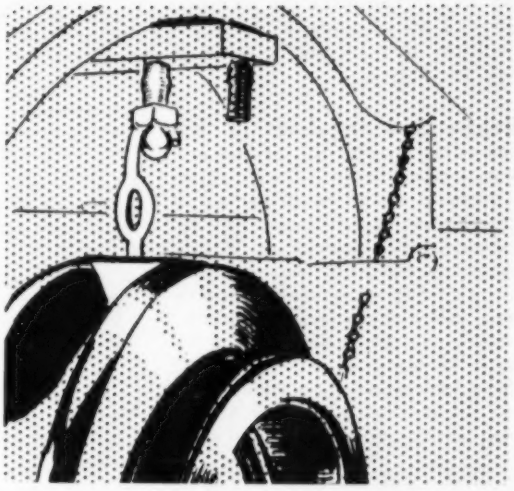
Balancing the load on the various power cylinders of a two-cycle gas engine with the pyrometers is an approved practice; however, when operating continuously at or near full load conditions, it is desirable that the engine be checked quite often with an indicator.

As pointed out previously, the cylinder exhaust temperature indicated by the pyrometer is a measure of the air-fuel ratio. It is an *indication* but not a *measure* of the horsepower de-

Improve Overhauls by . . .



. . . Speeding up Bearing Inspection. By placing a section of channel iron across the lower part of the crankcase and under the crank shaft, a hydraulic jack can be used to lift the crank shaft off the lower main bearing shell. During the lifting operation, a dial indicator is attached to a bridge which is installed over the crank shaft. After raising the shaft approximately .002 inch (as read on the dial indicator) the lower bearing shell can be readily rotated from under the shaft. A flexible steel cable with a "T" handle on one end and a small bolt in the other is used for removing this shell. **This is Figure 4.**



. . . Hanging Main Bearing Caps Inside the Crankcase. This simple hanger makes it unnecessary to manhandle the main bearing caps through openings in the crankcase, saving time, effort and possible damage to the engine. The piston wrist pin clearances are checked by clamping a dial indicator to a "C" clamp attached to the connecting rod and contacting the piston skirt. The piston is raised with a chain hoist while in the unit. The difference in the dial indicator reading while the piston is supported and unsupported gives wrist pin clearance. **This is Figure 5.**

veloped on each cylinder. As an example, assume that the air ports in one cylinder are becoming restricted with carbon, causing a reduction in the amount of air entering the cylinder. The fuel to air ratio is reduced; therefore, the temperature on the cylinder tends to increase above the temperature on the exhaust of the other cylinders. The operator observes this and reduces the amount of fuel entering the cylinder, bringing the temperature back to the average of the other cylinders. The cylinder on which the fuel has been reduced is no longer carrying its share of the load. Since no load has been removed from the engine, the other cylinders are now required to develop additional horsepower. If four cylinders on an eight-cylinder engine are reduced in this manner, considerable horsepower is transferred to the other cylinders, overloading them. The end result is that all cylinder exhaust temperatures are running above normal. If indicator cards were run on an engine under these conditions, it would be found that the four cylinders having the dirty air ports would have low peak cylinder pressures, while the four cylinders with the clean ports would have high peak cylinder pressures. High peak pressures may cause ring failures and will accelerate ring, cylinder and bearing wear.

The best practice is to balance the peak pressures on the cylinders frequently with an engine indicator. This will give more assurance that each cylinder is carrying its share of the load. If the cylinder exhaust temperature on some of the cylinders is high, the cause should be found and removed. If the ignition is good and properly timed, the air ports to the cylinder are probably becoming restricted with carbon and should be cleaned. For best performance of the engine it is advocated that each engine be fitted with proper facilities for connecting the indicator, and each operator be trained in the use of the indicator so that he can check the performance of the engine frequently and make adjustments when necessary. For best results it is desirable that peak pressure cards be run on one or two engines each shift so that all engines will be checked approximately every two days.

Another important part of a preventive maintenance program is the periodic "tune up." It was previously pointed out that spark plugs should be replaced periodically with reconditioned plugs. This should be scheduled along with other "tune up" practices so that the work will be uniformly distributed from week to week. This is beneficial in two ways. Assume that a compressor station has ten engines, and it is planned that all engines would be checked after ten weeks of operation. If such a plan were used, all of the engines would be approaching a condition where minor difficulties with ignition, etc., could reasonably be expected. In case of an overload, it would be possible to have the entire station go down. In addition it is possible that other unanticipated work could arise which would make it impossible that the engines be checked when scheduled. If one engine is "tuned up" each week, all other engines should be in better condition than the engine being "tuned." Also, only a small amount of work is required each week. If it is necessary to postpone the "tune up" of one engine for a time, very little loss in efficiency can occur.

The "tune up" of an engine should include the testing of all shutdown devices, inspection of magneto points, changing spark plugs, checking ignition timing and other equipment and devices which serve an important function in the operation of the engine. A record of these tests and the operating conditions should be made

Compressor Maintenance...

to be used in following the condition of the unit and equipment. A sample of a form used for this purpose is shown in Table 1.

Repair and Overhaul of Engines—Prior to the use of the procedure outlined in the following pages, the overhaul of the power end of an eight-cylinder engine required approximately 475 man-hours. At the present time the power end of a compressor is being overhauled in approximately 200 man-hours. This decrease in man-hours and accompanying reduction of downtime is due primarily to the coordination of the maintenance crews. In addition to this several time saving devices are now employed in the overhaul.

One of the devices is a one-ton air hoist. This hoist will lift one ton at the rate of approximately 17 feet per minute. The use of this hoist rather than a chain operated hoist has resulted in a saving of 36 man-hours and 11 hours compressor downtime in pulling and replacing the power pistons. The use of an eight-ton chain hoist normally provided will take three men a total of 40 man-hours to pull and replace these pistons. This work is now done with two men in four man-hours.

The improvement in the overhaul time of these units is also attributed to the following:

1. A portable scaffold four feet wide and the length of the catwalk was fabricated and installed on the compressors. The cylinder heads and other parts dismantled from that section of the engine are stored on the platform, eliminating need for lowering this material to floor. See Figure 3.

2. The piston racks were fabricated to provide a convenient and safe place to work on the pistons. This rack is shown in Figure 6.

3. Air-operated impact wrenches were used to remove practically all of the nuts and bolts from the engine when dismantling and reassembling. A five spot air piping manifold is used making it possible to operate several impact wrenches at the same time. See Figure 7.

4. A portable explosion-proof electric motor driven gear pump equipped with suction and discharge hoses was assembled for use in pumping the crankcase oil from the unit into barrels for storage during the overhaul of the engine. This is shown in Figure 1.

5. A one-ton air hoist as mentioned above is shown in Figure 2.

6. Main bearing cap hangers were fabricated which makes it unnecessary to remove the heavy bearing caps from the crankcase. See Figure 5.

7. In order to speed up the main bearing inspection a section of channel iron was cut to fit the lower part of the crankcase under the crank shaft which was used as a support for a hydraulic jack employed to lift the crank shaft off the lower main bearing shell. During the lifting operation, a dial indicator is attached to a bridge which is installed over the crank shaft. This arrangement is used to determine the exact lift of the crank shaft during the jacking operation. After raising the crank shaft approximately .002 inch, the lower bearing shell can be readily rotated from under the shaft. A flexible steel cable with a "T" handle on one end and a small bolt with a removable lug on the other end is used for removing this bearing shell. The equipment used in this operation is shown in Figure 4.

8. Adequate standard tools as well as specially designed tools are provided so that the overhaul can proceed without delay.

9. Piston wrist pin clearances are checked by clamping a dial indicator to a "C" clamp attached to the connecting rod and contacting the piston skirt. The piston is raised with a chain hoist while in the unit. The difference in the dial indicator reading while the piston is supported and unsupported gives the wrist pin clearance.

10. A definite overhaul procedure is established before work is begun. This includes reviewing records on the units to be overhauled to determine work to be done, the purchase of material before the overhaul is started and a check on the equipment to be used on the overhaul.

When the overhaul was started, three crews of four men each were used so that overhaul work could be performed 24 hours a day. As a result of the above improvements, the man-hours required for the overhaul were reduced from approximately 475 man-hours to 200 man-hours per unit. Downtime per unit was reduced to approximately 48 hours or six shifts. A breakdown of each shift follows:

Shift No. 1—Remove cylinder heads, coils, spark plugs, fuel injection valves, crankcase doors and covers, check wrist pin clearances, remove connecting rod bearings and pull and rack power pistons.

TABLE 1
Engine Tune-up Record

UNIT No. 5—SOUTH YEAR 1953

Date	1-29-53	4-6-53	9-1-53	10-6-53
Initial	F.L.C.	F.J	H.E.P.	F.J.
Water Temp. Shutdown	170	170	175	180
Oil Press. Shutdown	18	15	17	20
Overspeed Shutdown	350	345	340	355
Emergency Shutdown	OK	OK	OK	OK
Magnetos	OK	OK	OK	OK
Change Spark Plugs	OK	OK	OK	OK
Ignition Timing	OK	OK	OK	OK
Fuel Injection Valves	OK	OK	OK	OK
Lubricators	OK	OK	OK	OK
Pyrometer	OK	OK	OK	OK

Remarks: 10-8-53, Cleaned Ports, Cylinders 2 & 3.

OPERATING TESTS

Oil Pressure	43	44	42	42
Fuel Pressure	29	28.5	32	35
Scavenger Pressure	9.5	10	9	10
Ist. Stg. Suct. Press.	9.6	9.5	9.3	10.8
Ist. Stg. Pocket Set.	10.25	10.25	6.5	6.625
Engine RPM	300	300	310	309

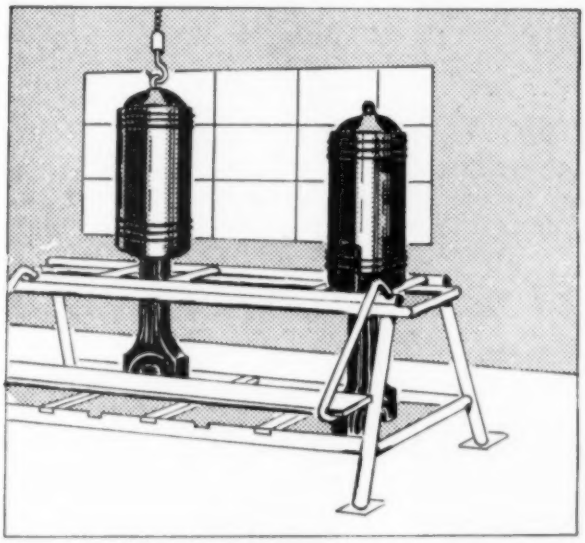
PYROMETER AND PEAK PRESSURE READINGS
Degrees Fahrenheit

Cylinder No. 1	610	620	700	700
Cylinder No. 2	610	620	645	720
Cylinder No. 3	620	610	645	745
Cylinder No. 4	620	660	640	695
Cylinder No. 5	610	620	660	705
Cylinder No. 6	620	610	660	680
Cylinder No. 7	610	610	665	680
Cylinder No. 8	610	620	640	670

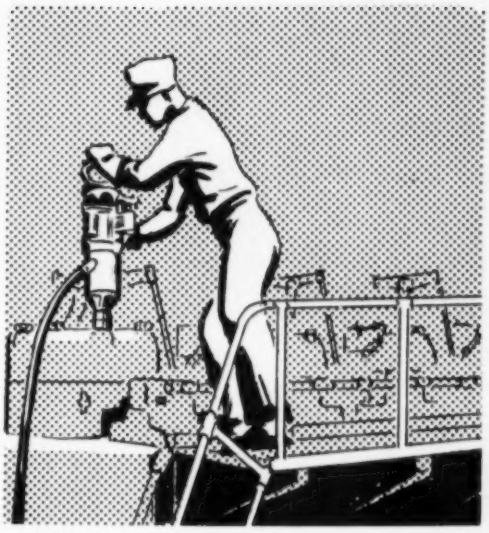
TABLE 2
Maintenance Report—Compressor—Downtime—1953

	Percent Down Time	Percent Total Down Time	Total Hours	NORTH 1	NORTH 2	NORTH 3	NORTH 4	NORTH 5	SOUTH 1	SOUTH 2	SOUTH 3	SOUTH 4	SOUTH 5
Engines													
Lube Oil System	0.07	5.73	64.5	....	7.5	2.5	9.75	....	5.25	4.00	18.5	11.75	5.25
Jacket Cooling	0	0.02	2.25	.25	.25	.25	1.25	.25	....	....	....	....	....
Fuel System	0.02	1.42	16.0	.5	.5	.75	1.0	.75	1.25	4.5	.75	2.0	4.0
Ignition System	0.03	2.60	29.25	.5	2.0	1.5	5.0	3.25	1.0	6.75	2.0	2.5	4.75
Scavenging	0.05	3.78	42.5	8.5	13.25	4.25	3.25	1.0	.75	.75	.5	2.75	7.5
Cleaning Ports	0.03	2.11	23.75	.75	1.25	1.5	2.75	....	3.5	5.25	2.5	2.75	3.5
Rings	0.03	2.51	28.25	7.25	....	....	....	....	7.75	3.75	3.75	1.0	4.75
Tune-up	0.12	8.89	100.0	9.25	9.75	11.0	12.5	9.5	11.75	13.5	6.75	6.25	9.75
Piston Heads	0.24	18.32	206.0	7.25	8.75	6.5	8.5	35.0	22.0	24.25	48.5	38.75	6.5
Governors	0.01	0.47	5.25	....	....	2.5	....	.5	....	1.25	....	1.0	....
Instruments	0	0.13	1.5	....	....	....	....	....	....	.25	....	.25	1.0
Gaskets	0	0.36	4	....	....	....	2.5	....	....	....	1.25	.25	....
Overhaul	0.30	23.48	264.0	44.75	41.25	40.5	52.5	46.0	39.0	....	....	....	....
Pistons	0.02	1.53	17.25	....	....	....	....	....	17.25	....	....	....	....
Cylinders	0.08	6.53	73.5	....	....	.25	....	....	17.25	23.0	....	....	33.0
Inspection	0.01	0.87	9.25	4.5	....	....	.25	....	4.5	.5	....	....	....
Plant Shutdown	0.01	0.89	10.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Air Filter	0	0.22	2.5	....	....	....	....	....	....	1.5	1.0	....	....
Misc.	0.02	1.20	13.5	....	1.25	1.5	2.25	1.25	1.75	1.25	1.0	2.0	1.25
Compressors													
Packing	0.01	0.76	8.5	....	....	....	....	....	....	3.5	....	5.0	....
Jacket Cooling	0	0.27	3.0	....	....	....	....	....	....	....	3.0	....	....
Rods	0.02	1.93	21.75	....	....	....	....	....	....	14.0	....	7.75	....
Magnafluxing	0.05	4.22	47.5	5.25	5.5	6.5	3.75	4.75	5.25	4.00	3.25	3.75	5.5
Valves	0.09	7.38	83.0	6.5	6.0	3.75	5.25	10.0	7.25	9.25	16.75	5.0	13.25
Gaskets	0.01	0.80	9.0	....	....	....	....	....	....	....	....	9.0	....
Cross Heads	0.01	0.87	9.75	....	9.75	....	....	....	....	....	....	....	....
Clearance Pockets	0	0.18	2.0	1.5	....	....	.5	....	....	....	....	....	....
Overhaul	0.03	2.0	22.5	8.5	....	....	....	....	....	....	6.75	7.25	....
Misc.	0	0.35	4.0	....	....	....	....	....	.25	1.5	1.0	.75	.5
Total	1.26	100.00	1124.75	106.25	108.0	84.25	112.0	113.25	146.75	123.75	118.25	110.75	101.5
Percent Downtime Engine:	1.04	....	....	0.10	0.10	0.09	0.12	0.11	0.15	0.10	0.10	0.08	0.09
Percent Downtime Compressor:	0.22	....	....	0.02	0.02	0.01	0.01	0.02	0.01	0.03	0.04	0.04	0.02
Total	1.26	....	....	0.12	0.12	0.10	0.13	0.13	0.16	0.13	0.14	0.12	0.11

Improve Overhauls by . . .



. . . Fabricating Piston Racks to provide a convenient and safe place to work on pistons. Notice the seat which is placed at convenient height. The pistons are lifted out of the engine and into the rack by means of an eye screwed into the piston head. **This is Figure 6.**



. . . Using Air-Operated Impact Wrenches to remove practically all the nuts, and bolts from engine when dismantling and reassembling. A five-spot air piping manifold is used to make it possible to operate several impact wrenches at the same time. **This is Figure 7.**

Shift No. 2—Inspect and re-install main bearings. Clean carbon from ring lands on pistons and fit with new rings.

Shift No. 3—Inspect and re-install main bearings. Clean carbon from ring lands on pistons and fit with new rings.

Shift No. 4—Inspect and adjust compressor and scavenger connecting rod bearings, clean jacket water connections, clean carbon from air intake ports, mike pistons and cylinders and run glaze buster on cylinders.

Shift No. 5—Install pistons in cylinders, adjust connecting rod bearings and start assembling top part of unit.

Shift No. 6—Complete reassembly of unit, clean crankcase, start unit and begin moving overhaul platforms, etc., to next unit to be overhauled.

Material Selection and Life—Material failures are the result of poor or incorrect material, improper design or the mis-treatment of the material being used. The first step in the analysis of material is the preparation of a complete downtime report similar to that shown in Table 2. Assuming that this record reflects only downtime for the repair or replacement of faulty material, and not inefficiencies in the performance of the actual work, it can be used to locate failures causing downtime. Without this report only the obvious weaknesses will be noticed.

After it is determined from the downtime report that a specific problem exists, the second step is to thoroughly analyze the cause of the failure, determining whether the failure resulted from poor or incorrect material, improper design or the mistreatment of the material. After completing this investigation, it is usually possible to make improvements which will extend the operating time between failures of this particular part.

As an example of this problem and what can be accomplished, the solution of a power piston ring problem will be presented. Prior to the investigation of this problem, the practice followed at this compressor station was to replace all power piston rings annually. Many ring failures were experienced between ring replacements, causing considerable downtime.

After analyzing the problem, it was decided a better lubricating oil would be desirable and that a change in ring design would probably be beneficial. The use of a better lubricating oil was started and one set of piston rings of an improved design was installed for an experimental run. After observing the improvements resulting from these two changes after one year of operation, it was decided to use the better lubricating oil and install rings of the new design in all units.

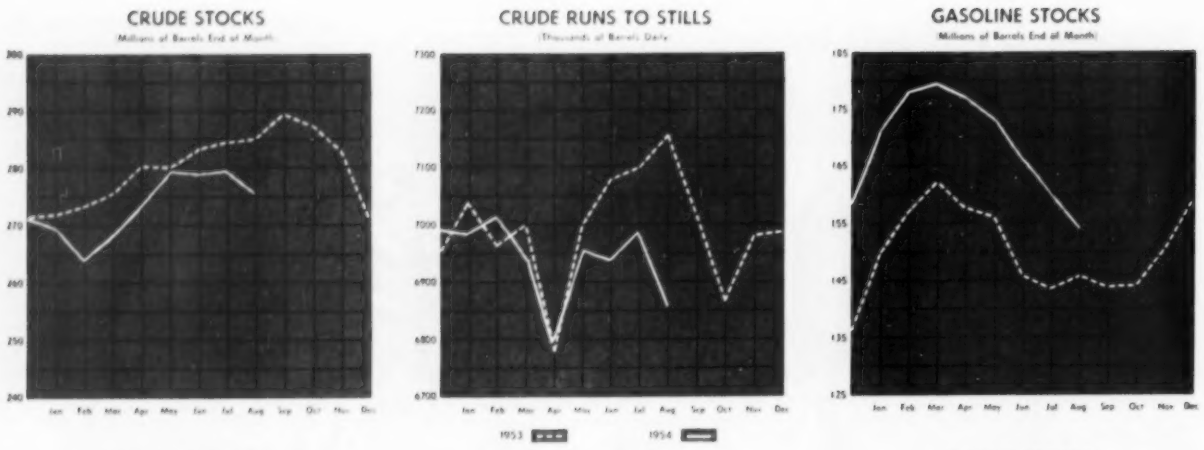
This station now replaces power piston rings every two years and very seldom experiences ring failure. A problem of this nature is of major importance and will show considerable improvement in both downtime and maintenance expense; however, there are many minor problems experienced in engine operation that can be analyzed and corrected and give the same results.

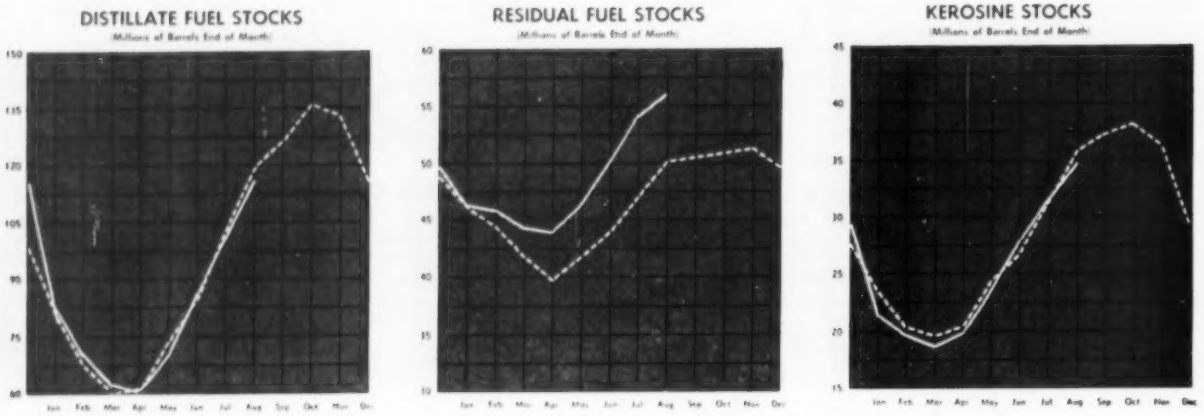
The downtime report shown in Table 2 reflects an annual downtime of 1.04 percent for the power end. This report is for a compressor station having ten 1600 horsepower engines.

Many of the problems encountered with the engines in this station have been solved. The downtime for maintenance of the power end has been reduced from 4.7 percent since the start of operation approximately four years ago. During 1953, an average of 500 man-hours per month was used for the maintenance of these engines, including the bi-annual overhaul.

In the maintenance of a compressor station the study of material selection and life is a never ending problem. Material manufacturers are constantly endeavoring to improve material and design of parts.

Original presentation was before the 33rd Annual Meeting, Natural Gasoline Association of America, Dallas, April 21, 1954. ##




DISTILLATE FUEL STOCKS
(Millions of Barrels End of Month)
RESIDUAL FUEL STOCKS
(Millions of Barrels End of Month)
KEROSINE STOCKS
(Millions of Barrels End of Month)

Taking Stock

Cecil W. Smith
Economics Editor

(DATA IN THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		KEROSINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1952:													
November	6,487	7,049	267,852	3,416	129,509	393	32,199	1,510	116,096	1,299	53,089	624	984
December	6,634	6,952	271,928	3,361	136,028	421	26,842	1,509	99,582	1,302	48,706	603	1,165
1953:													
January	6,555	7,042	272,250	3,384	150,518	433	23,292	1,528	80,655	1,307	45,910	616	1,135
February	6,562	6,969	273,589	3,379	157,873	404	20,468	1,505	67,167	1,275	44,178	586	1,066
March	6,531	7,002	275,665	3,319	162,731	359	18,697	1,485	59,802	1,256	41,600	655	1,112
April	6,446	6,781	280,487	3,292	158,032	361	20,335	1,424	61,349	1,219	39,572	628	1,010
May	6,390	7,002	280,308	3,366	156,415	327	24,307	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	326	27,659	1,462	84,504	1,238	43,801	707	1,050
July	6,603	7,103	284,976	3,583	143,916	321	31,143	1,441	102,258	1,224	47,530	629	950
August	6,583	7,163	285,352	3,592	146,050	321	35,711	1,437	119,542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	330	37,280	1,448	126,709	1,203	50,516	692	1,013
October	6,262	6,872	287,541	3,437	144,495	355	38,161	1,462	135,409	1,184	50,820	639	990
November	6,277	6,987	283,021	3,528	150,747	354	36,271	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	378	29,070	1,441	111,944	1,247	49,370	598	1,121
1954:													
January	6,240	6,947	270,811	3,431	171,704	390	22,013	1,467	81,044	1,271	47,474	617	1,143
February	6,379	7,068	266,918	3,476	179,950	412	20,183	1,545	70,390	1,241	47,119	621	1,144
March	6,507	6,923	271,867	3,375	181,297	353	17,533	1,458	60,270	1,168	44,249	654	1,088
April	6,615	6,811	280,310	3,404	177,006	322	19,656	1,374	61,721	1,140	44,362	574	950
May	6,471	7,038	282,250	3,482	177,606	302	23,892	1,372	73,581	1,148	47,009	708	1,021
June	6,500	6,947	285,155	3,483	165,404	306	28,184	1,399	86,325	1,123	50,216	624	999
July	6,282	6,922	279,744	3,378	158,174	305	31,535	1,412	101,101	1,108	54,735	686	1,011
August	6,147	6,859	275,543	3,388	153,608	303	34,891	1,438	116,398	1,092	56,069	683	972
Week Ended:													
9-17-54	6,196	6,969	272,695	3,407	151,787	330	37,644	1,435	124,021	1,101	57,268	584	874
9-18-53	6,495	6,992	283,577	3,437	141,648	285	36,822	1,389	125,849	1,218	52,164	699	1,088

Source: Data for last two months from API; prior monthly data from Bureau of Mines.

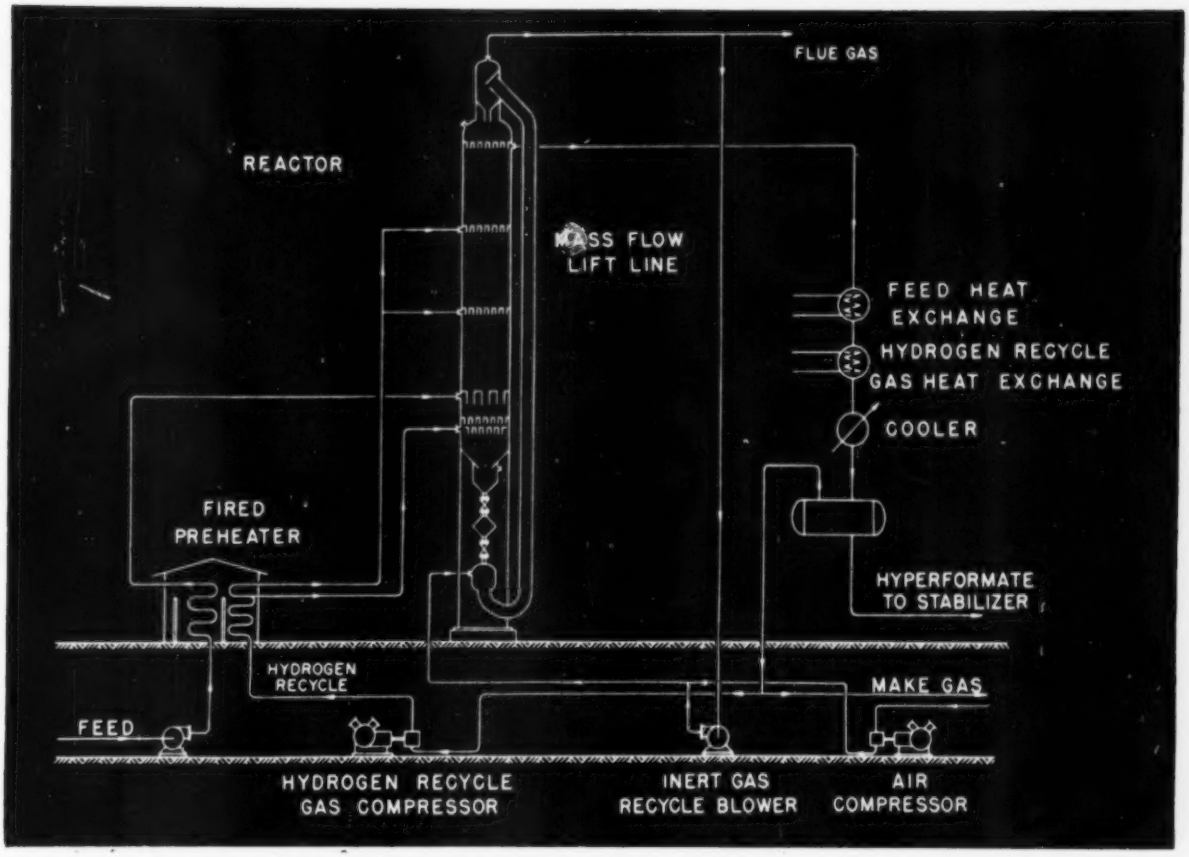


Figure 1. Flow sheet of commercial Hyperforming unit.

The Design of Hyperforming Units

Data on the first commercial application of this new process are carefully analyzed and reported.

Clyde Berg,
Union Oil Company of California,
Los Angeles

THE HYPERFORMING process is a general purpose reforming and stock upgrading operation utilizing the new "Hyperflow" catalyst-handling technique. It carries out the reforming of straight-run naphthas, as well as blends of straight-run and cracked stocks, to effect major uplifts in gasoline quality. Very high octane values can be attained because of the feature of continuous catalyst regeneration. Low-grade stocks containing substantial quantities of sulphur and nitrogen are processed readily.

The first commercial Hyperformer processes a mixture of visbreaker pressure distillate and straight-run gasoline from Los Angeles Basin crude, to produce premium motor gasoline. In its operation the unit contacts naphtha feed together with a hydrogen-containing recycle gas, over a moving catalyst bed at a temperature of 870 F. and a pressure of 400 psig.

The reactor of this 1100-barrel-per-day unit is 30 feet long and 4½ feet in diameter. The catalyst is cobalt-

molybdate on a stabilized alumina base, formed into 3/16-inch pellets. A yield of 91.7 volume per cent C_5+ gasoline is obtained. This product is blended with 9 percent outside butane to produce an over-all yield of 104.4 percent 10-RVP gasoline having an F-1 + 3cc TEL octane rating of 93.7. The product is sweet and contains 0.007 weight percent sulphur as compared with 0.579 percent sulphur in the feed charge.

Basic Operation—The Hyperforming process utilizes the general solids-handling techniques developed in many years of commercial operation of the Hypersorption process. The reactor incorporates solids-handling features providing very precise control of catalyst motion at all points.

In Figure 2 is given a diagram of the basic Hyperforming process. It will be noted that the catalyst moves downward through the reactor under gravity flow and is returned back to the top of the reactor by means of mass conveyance in a catalyst-transfer line. Simultaneously with this vertical lift, regeneration is carried out. By the use of continuous regeneration in the course of catalyst movement, a substantial economy in plant construction is effected and plant maintenance is reduced over that of cyclic processes. The flow diagram for a typical Hyperforming unit is presented in Figure 1. The feed naphtha is heat exchanged with the reactor effluent, heated to approximately 870 F. and introduced into the bottom of the reactor at approximately 400 psig. The naphtha vapor together with recycle gas, flows upward countercurrent to the catalyst, and hot hydrogen is introduced at several interheating points. The naphtha leaves the top of the reactor as a thoroughly refined product. After passing through the naphtha preheat exchanger the vapors flow through a polymer knockout cyclone, are cooled, and the recycle gas and liquid product separated. As a final step, the Hyperformate is stabilized and butane-blended to produce approximately a 10-pound RVP product.

TABLE 1
Comparison of Hyperflow and Dilute-Phase Solids Conveyance

Dilute Phase	Hyperflow
1. Solids suspended in gas stream. Apparent density of flowing stream much less than that of gravity packed solids mass	1. Solids in compact unfluidized mass. Density of flowing stream substantially the same as a compact downward moving solids bed
2. High gas and solids velocity	1. Low gas and solids velocity
3. Low pressure differential required	3. High pressure differential required
4. Large quantities of lift gas required	4. Small quantities of lift gas required

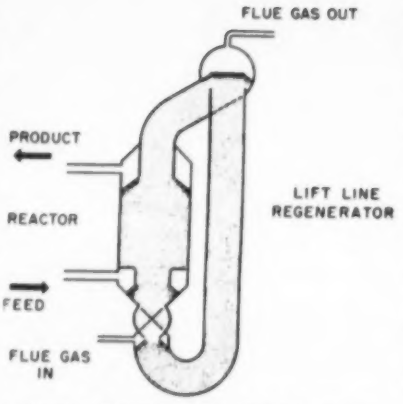


Figure 2. Diagram of Hyperforming process.

Catalyst Transfer—A special feature of the Hyperforming process is the use of the Hyperflow lift-line principle to convey the catalyst at very low velocity and minimum attrition loss. The general principle of Hyperflow is illustrated in Figure 3, which presents a comparison between the new mass-flow principle of moving solids and that of the dilute-phase technique. The difference in nature of transport of solids by these means is outlined in Table 1.

Upward movement of solids in the Hyperflow catalyst-transfer line is essentially the same as the downward movement of the same material in a gravity feed line.

Hyperflow may be considered as a "reverse gravity" solids conveyance system wherein each particle is pressing on the others surrounding it so that the particles move as a mass in the direction of transport, rather than being suspended and dispersed from each other in a gaseous transport medium, as they are in conventional dilute-phase lifting. The upward movement of the bed of solids in a Hyperflow system, when seen in a transparent plastic model, is similar in appearance to the downward movement of a bed of the same material in a gravity feed line.

In the Hyperflow system of solids movement, the solids move from a charging chamber of higher pressure through a precisely engineered line to a low-pressure point in a solids-delivery vessel. Gas normally is used to pressurize the charging chamber; however, any means of imposing an elevated pressure on the solids mass may be employed and a liquid can be utilized for this purpose. The object of the flow is to establish a uniform force gradient from the charging chamber across the transport line. This force gradient is set up in interparticle contact of the solids being transported. The generated interparticle force is similar in its effect to that of the force of gravity on a static bed and the solids are moved by this force according to the laws and phenomena that are characteristic of gravity flow of solids beds. Hyperflow provides flexibility of flow in any direction by deliberately setting up the force of interparticle contact as desired. Movement is slow and steady, there is no turbulence, and the density of the mass is such that the interstices and void volume are the same as in a static bed of the material.

Catalyst Regeneration—Regeneration of the catalyst is carried out in the hyperflow lift line employing a recycle of flue gas containing an oxygen content below 2 percent. While being regenerated, the catalyst is lifted to the top of the reactor. Catalyst enters the lift line through a simple lock system located at the base of the reactor. Elutriation of fines is effected at the flue-gas disengaging point at the top of the lift line and the hot flue gases are cooled by heat exchange with feed naphtha and then pass to the suction of the circulating blower. Removal of catalyst dust is effected in a small cyclone separator. In the lift line the combination of a moving bed, together with controlled oxygen content, limits the peak temperature rise and provides precise control with the assurance of moderate conditions in the removal of coke from the catalyst.

Process Control—The reactor pressure is controlled by throttling on the make-gas effluent. Temperature in the catalyst bed is controlled by injection of hydrogen at two points to make up for endothermic reaction affects. Catalyst flow is controlled by a moving tray at the base of the reactor, similar to those used in Hypersorption units.

Details of Typical Reactor Design—In Figure 4 is presented a cross section of the reactor of a typical Hyperforming unit. It will be noted that the recycle gas is introduced below the feed inlet and serves to strip the catalyst and partially hydrogenate any retained hydrocarbons at that point. The naphtha and hydrogen traverse the reactor countercurrent to the catalyst, and hot hydrogen is introduced at two points to maintain reaction temperature. In Figure 5 is presented the assembly detail of this

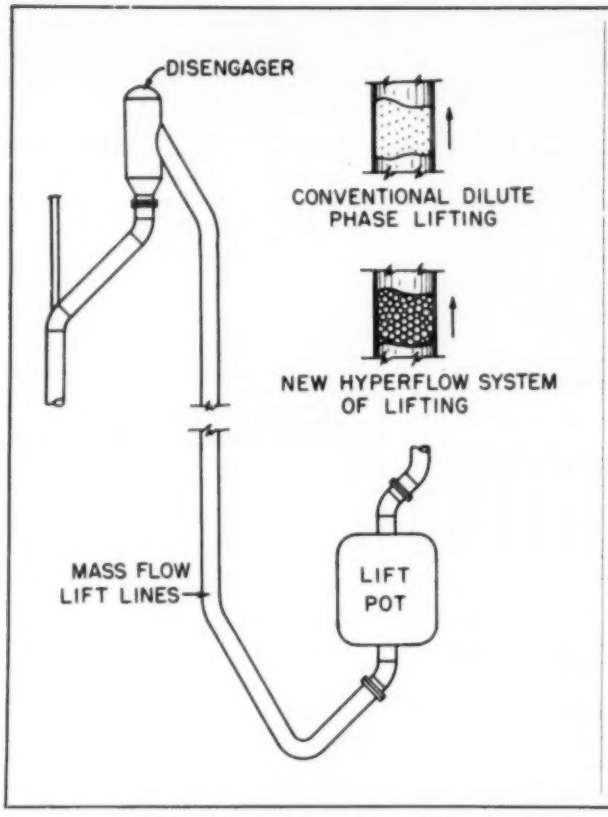


Figure 3. General principle of Hyperflow.

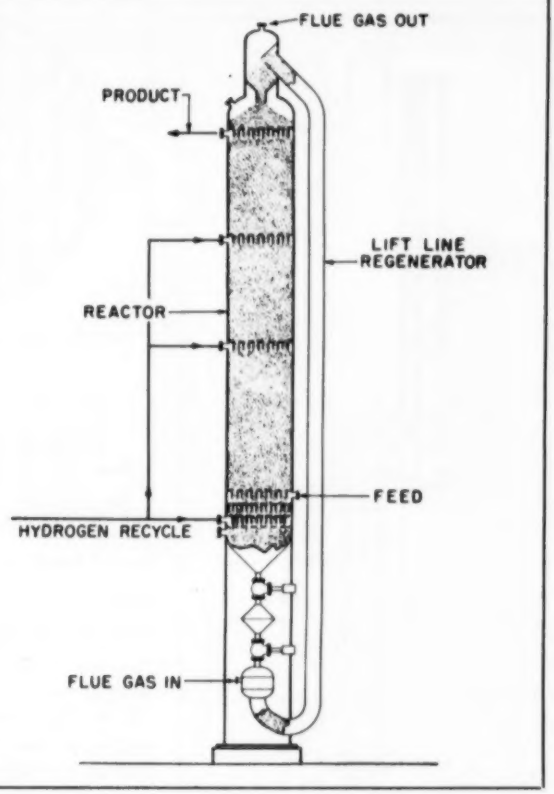


Figure 4. Cross section of Hyperforming unit.

reactor. This general reactor design is used in the refining of both high and low naphthene-content straight-run stocks, as well as high-sulphur cracked naphthas.

Construction of Reactor Internals—Figure 6 presents the construction of feed-engaging and disengaging trays employed as internals in the Hyperforming unit. These trays have a number of geometrically arranged downspouts which serve to conduct the solids downward in a uniform manner throughout the cross-sectional areas of the reactor. Disengaging or engaging of the vapors occurs underneath the trays and a number of inlet and outlet points are employed to minimize the pressure drop in vapor distribution across large-diameter trays.

In Figure 7 is illustrated the solids flow-control mechanism located at the base of the reactor. It consists of a circular tray supported at three points and given an oscillating motion. This tray has a number of downspouts which serve as pockets for the displacement of solids. When in one extreme of its motion, alternate downspouts of this tray are in position to be filled by the delivery tubes in the fixed tray above. These pockets do not discharge because in this position they are sealed by the tray below. As the tray moves to the opposite extreme in its travel these downspouts pass into position over discharge holes in the tray below and are emptied.

A novel type of solids-level indicator is utilized in the catalyst-surge chamber located at the base of the reactor. It employs a grid inserted into the moving bed of solids and gives continuous and dynamic indication of solids level. A diagram of this level indicator is shown in Figure 8. The grid is immersed in the solids and directly measures the internal force specifically related to the density of the material and the depth of the bed. The accuracy and sensitivity of response is comparable to that of the more refined liquid-level indicators.

TABLE 2
Hyperforming Capital Investment Charges

Capital investment, $/bbl. of daily capacity	150-300
Initial catalyst cost, $/bbl. of daily capacity	20

Capital Investment—Capital investments for Hyperforming are moderate. This occurs partially because of the low volume of recycle gas circulated, with its attendant reduction in required heat exchanger, furnace and compressor facilities. Regeneration facilities are minor. Because of continuous plant operation with uniformly high catalyst activity, recycle gas of constant composition is handled and gas handling equipment does not have

TABLE 3
Signal Hill Hyperforming Unit Products

FEED	Bbl./SD	MSCF/D	°API	Lbs./Hr.	Liquid Yield Vol. Percent	Yield Weight Percent
Naphtha	1100		46.3	12750	100.0	100.0
Products:						
C_5+ gasoline	1008		48.2	11560	91.7	90.8
Butanes	40			330	3.7	2.6
Polymer	6.6		24.0	87	0.6	0.6
Make gas[a]		620		1282		
Coke[b]				19.1		0.15
Coke equivalent for oxidn. of H_2 and catalyst				(19.7)		

[a] Bleed gas and depropanizer Off gas.
[b] Combustion products from catalyst regeneration are included in make gas.

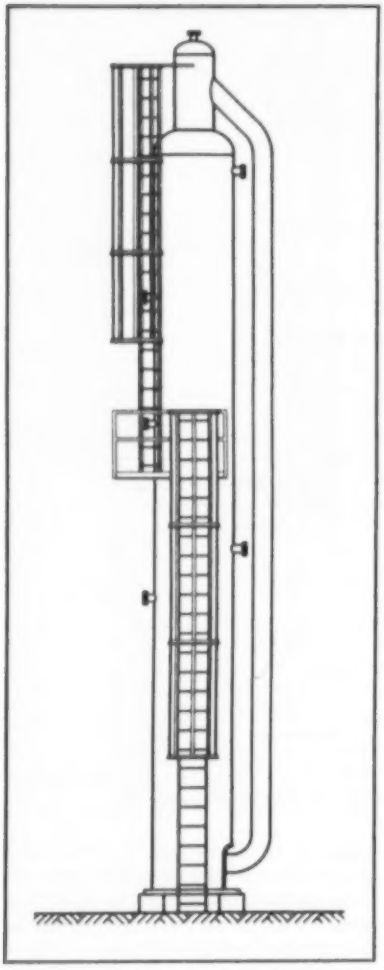


Figure 5. Assembly detail of Hyperforming unit.

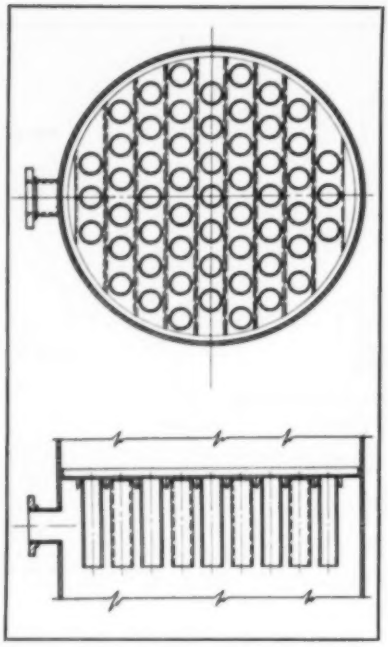


Figure 6. Feed-engaging and disengaging tray construction.

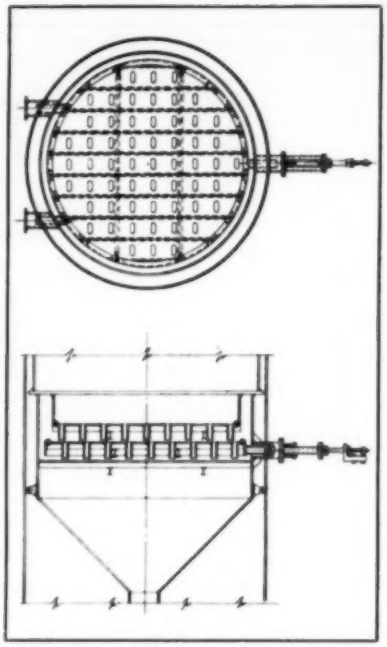


Figure 7. Solids flow-control mechanism.

to be over-designed to handle off-grade processing conditions, such as occur periodically in fixed-bed operations.

Capital investment and initial catalyst costs are given in Table 2.

The charge capacity of the plant is the principal variable determining the actual magnitude of plant costs. To a lesser degree, cost is affected by sulphur content of the charge stock, in that it determines alloy requirements.

Signal Hill Hyperformer—The first commercial Hyperformer located at Signal Hill, produces high-quality Hyperformates for use in motor gasoline. Feed stock consists of a blend of heavy straight-run naphtha obtained in the operations of a 2500-barrel-per-day topping and rerun plant, together with heavy thermally cracked naphtha obtained in the visbreaking of the residue produced in the same crude-topping operation. The charge stock boils between a temperature of 241 to 418 F., has an API gravity of 46.3, and an F-1 + 3cc TEL octane rating of 73. The stock also contains 0.579 weight percent sulfur and 0.020 weight percent nitrogen. The material balances and product distribution in the operation of this plant are given in Table 3.

A yield of 91.7 volume percent C_5 + gasoline is obtained, which blends to a 104.4 volume percent yield of 10-pounds RVP gasoline, with the addition of 9 percent outside butanes. F-1 + 3cc TEL octane ratings up to a level of 99.0, could be produced in this plant without production of excess butanes in blending to 10-pounds RVP.

Product Quality—In Table 4 is given the qualities of the product which is obtained in operation of this Hyperformer.

The 10-pound RVP gasoline has an F-1 + 3cc TEL octane rating of 93.7. The sulfur content of the product is very low, amounting to 0.007 weight percent. Extensive studies on road performance and blending qualities of hyperformate of this general character have shown it to have excellent properties.

Process Condition—A summary of the processing conditions for the Signal Hill Hyperformer is given in Table 5.

Equipment—In Figure 9 is presented an isometric drawing of the plant layout showing the arrangement of the feed pump, furnaces, exchangers, and product separator.

The dimensions of the major vessels of the Signal Hill Hyperforming unit are listed in Table 6.

The reactor is fabricated from low chrome-moly steel. All other vessels are of carbon steel. No refractory liners are used in the reactor or catalyst-transfer lines. The high-temperature furnace tubes and transfer lines are of alloy. Two disk-type valves of a special design are used with the lock

TABLE 4

Signal Hill Hyperforming-Unit Data on 10-Pound RVP Gasoline

Yield of 10-lb. RVP gasoline, volume percent	104.4
Outside butane	9.0
Gravity, °API	52.8
Octane ratings:	
F-1 Clear	83.0
F-1 + 3cc TEL	93.7
Engler Distillation, Deg. F.:	
Initial	97
10 percent	168
50 percent	280
90 percent	380
95 percent	405
Maximum	427
Sulfur, weight percent	0.007

TABLE 5

Signal Hill Hyperformer Process Conditions

Reaction Conditions:	
Temperature, deg. F.	870
Naphtha preheat, deg. F.	870
Recycle gas preheat, deg. F.	850
Interheater preheat, deg. F.	1050
Pressure, psig	400
Space velocity, volume of naphtha per volume catalyst in reactor	1.0
Catalyst to oil ratio, volume catalyst circulated per volume of naphtha	0.05
Recycle and interheater gas, scf/bbl. naphtha	3600
Recycle gas, hydrogen content, mole, percent	65
Regeneration Condition:	
Regeneration temperature, deg. F. avg.	950
Pressure, psig, average	415
Coke load, weight percent feed	0.15

vessel at the base of the reactor. The plot dimensions for the boundary limits of the unit are approximately 40 x 80 feet. The elevation at the top of the Hyperformer reactor is 42 feet.

Utility Requirements—Table 7 gives the utility requirements for this plant.

The circulation of catalyst in the Signal Hill Hyperforming unit is very low. Approximately 860 pounds per hour of catalyst is circulated in this plant which processes 1100 barrels daily of combined feed stock. This low catalyst circulation, combined with the reduced attrition effects provided by the use of the Hyperflow-conveying principle, leads to minimum over-all costs in catalyst makeup. Because the over-all process is continuous, fluctuation in product quality or processing conditions as a function of processing period, does not have to be accommodated.

Operating Costs—Estimated operating costs for this plant are given in Table 8.

The utility costs are based on fuel gas at 16 cents per thousand cubic foot, cooling water at a cost of 0.078 cents per cubic foot, power at 0.7 cents per kilowatt hour and catalyst at a cost of $1.30 per pound. It is estimated that one man with supervision will operate the unit and credit is taken for the fuel value of the dry gas produced. Resulting net cost of plant operation is less than 12 cents per barrel.

Original presentation was at the Ninth Annual Petroleum-Mechanical Engineering conference of the American Society of Mechanical Engineers, September 1954, Los Angeles. # #

TABLE 6

Signal Hill Hyperformer Dimensions of Major Vessels

	Diameter	Length
Reactor	4'—6"	30'—0"
Catalyst pressuring pot	1'—8"	2'—0"
Product separator	4'—0"	8'—0"
Stabilizer	3'—0"	34'—0"

TABLE 7

Signal Hill Hyperformer Utility Requirements

Fuel Gas, MBtu/hr.:	
Produced by unit (710 Btu/SCF)	18400
Required by unit for fired heaters	11350
Net production from unit	7050
Instrument air, SCF/min	45
Cooling water, gpm (38 deg. rise)	263
Electrical Power, kw:	
Lighting and instruments	25
Pumps and compressors	92
Total	117
Catalyst makeup, lb./SD	9.0

TABLE 8

Estimated Operating Cost 1100-Barrel-Per-Day Signal Hill Hyperformer

	¢/Bbl.
Utilities:	
Fuel gas at 16 cents per MmBtu	4.0
Power at 0.7 cents per kw hour	2.6
Water at 0.078 cents per cu. ft.	0.4
Catalyst at $1.30 per lb. (Process guarantees on the order of 3 cents per bbl. can be obtained)	1.0
Labor	6.0
Operating supplies	0.2
Maintenance and general overhead	3.5
	13.7
Credit for fuel gas produced at 16 cents per MmBtu	6.7
Net cost (exclusive of royalty)	11.0

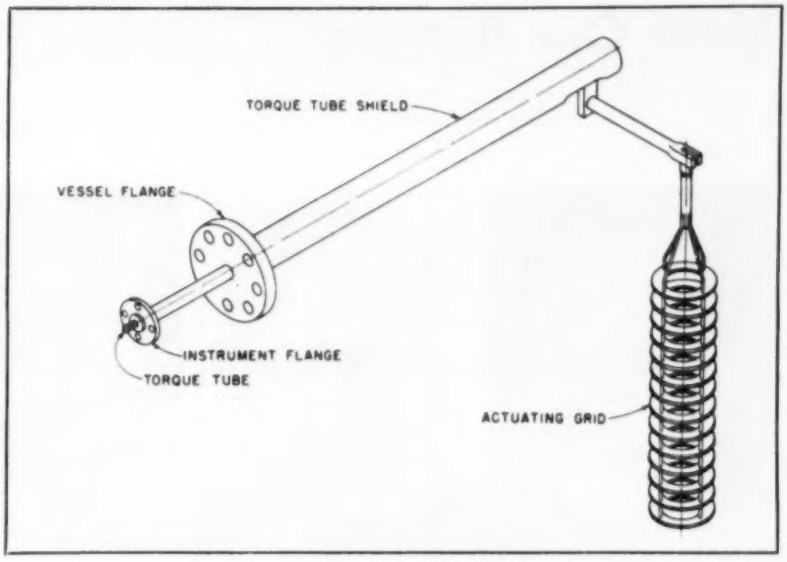


Figure 8. Level indicator employed in Hyperforming.

ACKNOWLEDGMENT

The author wishes to express his appreciation to Union Oil Company of California for permission to publish this description of the Hyperforming process and to acknowledge the contributions to the development, both in pilot-plant operations and design studies, by F. C. Wood, R. P. Vaell, C. P. Reeg, W. I. Barnet, R. O. Dhondt, J. G. Claypool and N. D. Koch. Thanks are also extended to Howard Kehde, J. E. Hines, Jr., R. R. Montgomery, R. D. Clerk, and J. M. Miller for their technical advice in this work.

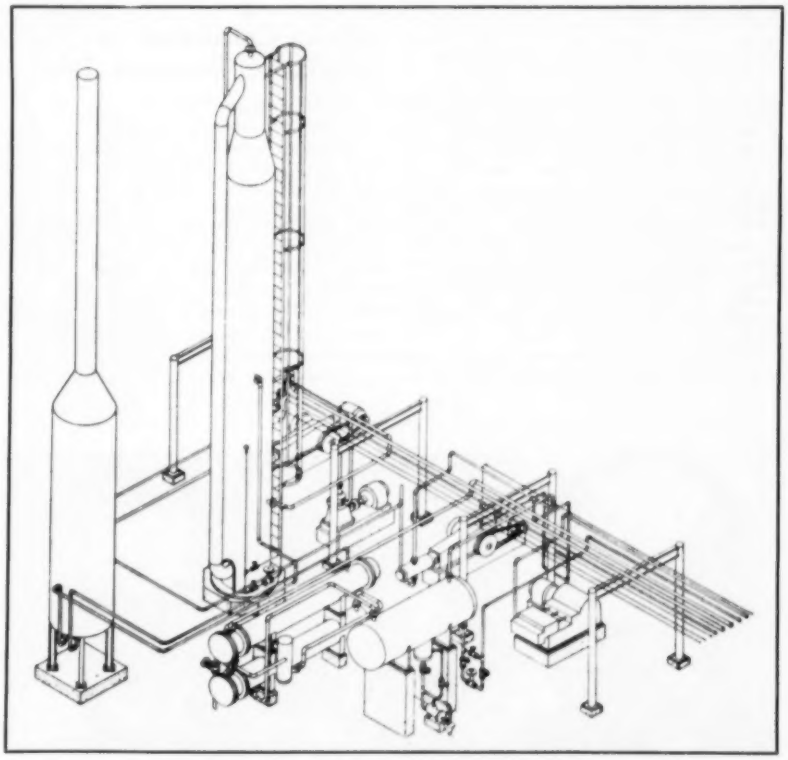


Figure 9. Isometric view of Hyperforming unit.

Meet Our Authors . . .

J. J. Watt

C. E. Headington

W. B. Brooks

Clyde Berg

Watt and Headington Fit Pattern in Sharing Find

J. J. Watt and C. E. Headington, "New Viscometer Solves Old Problems," page 121.

When most of us get hold of something "good," we usually hustle to tell others about it. J. J. Watt and C. E. Headington follow the pattern, with a slight toning down of "hustle."

For years they have lived with the instrument about which they write at The Atlantic Refining Company. Now they want to tell others about it.

Watt has been with the company 28 years, the last 14 as supervisor of the Standard Laboratory in the Product Control department. Before joining Atlantic he attended the University of Pennsylvania and Drexel Institute of Technology. A gregarious sort, he is affiliated with the ASTM Committee D-2, concerned with work on Newtonian liquid viscosity methods. His chief pastimes are taking movies and birds. His family (not necessarily in order of importance): one son, two daughters, one wife and one mother-in-law.

Headington has been with Atlantic since 1929, the year he received an A.B. degree from Upper Iowa University and an M.S. degree from Iowa State College. He presently directs the Analytic division of the Research and Development department. Eating, sleeping and looking (at mountain scenery) rank high on his list of things worth doing, while rainy days, Malenkov and people who snore head his "black" list. An Iowan he is currently sharing parental pride with his wife because their son began Penn State last month.

Brooks Calculated in Work and Personal Taste

W. B. Brooks, "Sea Water as an Industrial Coolant," page 127.

Metallurgy is W. B. Brooks' field. It has been since 1933 when he joined Allegheny Steel Company as assistant plant metallurgist. Since then he has has been a metallurgical consultant and a metallurgist with three other companies. Since 1948 he has been research and development engineer in The Dow Chemical Company's Texas division at Freeport. His job at Dow: metallurgical and corrosion engineering.

Brooks was born at Goettingen, Germany (while his American father was in residence for a Ph.D. degree) and studied metallurgy at Colorado School of Mines.

As the singleness of purpose in his career indicates, Brooks knows his own mind. Without a moment's hesitation he can list for whoever asks his likes, "New England lobster, Yankee beef and good bull sessions," or his dislikes, "certain radio commentators, progressive education and spinach." A well organized man is W. B. Brooks.

Berg Chalks Up Another On List of Process Work

Clyde Berg, "The Design of Hyperforming Units," page 153.

Clyde Berg is manager of process development at Union Oil Company of California, which accounts for his intimate knowledge of the Hyperforming process, which is licensed by Union Oil.

He joined the process design and development group of Union Oil in 1940 soon after obtaining his Ph.D. degree from the University of Minnesota. He was appointed supervisor in charge of process development in 1942, assistant to the vice president in charge of research and development in 1949, and manager of process development in 1951. Under his direction, a wide range of processes have been developed. He has published articles on hypersorption, retorting and refining of shale oil, catalytic refining, solvent extraction and distillation.

Berg was graduated from the University of Minnesota in 1936. During his post graduate work he instructed in the Chemical Engineering Department and was awarded the Hormel Research Fellowship. For a change in pace from process work, he goes in for sailboat racing, and swimming and golf on poor sailing days.

E. C. Hermann

S. W. Dedman

J. W. Smalling

More Authors Page 160

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J. F. Socolofsky | Leonard Raymond | F. A. Upson | E. R. Wagner

Hermann Has Followed Course Set by Degrees

Eugene C. Hermann, "Maintenance Organization Pays Off," page 141.

Eugene C. Hermann has been a chemical engineer at Eastman Kodak Company, Standard Oil Company of Louisiana, Standard Oil Development Company and Esso Standard Oil Company. All of this came after he received a B.S. degree in chemical engineering from Massachusetts Institute of Technology in 1925, and an M.S. degree in chemical engineering practice from the same school a year later.

Today, with that trail of consistency behind him, he's head of maintenance and construction at Esso's Bayway refinery at Linden, N. J.

What time he has free, Hermann devotes to "men's affairs" at the Westfield, N. J., Presbyterian Church, activities in various organizations and a little golf. But, of course, the person having first call on his "free" time is Mrs. Hermann, who, with her husband, is proud of their two sons, Chris, 14, and Eugene, Jr., 22, who is a Naval aviator.

Askey, Dedman, Smalling Have One Company Careers

W. E. Askey, S. W. Dedman and J. W. Smalling, "New Catalyst Recovery Device," page 137.

Humble Oil & Refining Company has been "it" as far as the careers of W. E. Askey, S. W. Dedman and J. W. Smalling are concerned.

Askey, chemical engineer at Humble's Baytown, Texas, refinery, has been with the company since being graduated from Oklahoma A. & M. What time he has "free" he devotes to his many hobbies, all of which can be "classified under loafing."

Dedman, senior mechanical engineer at Baytown, has been with the company seven and a half years, having joined it immediately after his graduation from Texas A. & M. In his present capacity, he is concerned with engineering projects on various units at the refinery. Photography and yard work keep him busy during his leisure time.

Smalling, assistant general foreman in the Light Ends department at Baytown, has been with Humble ten years, six years in the Technical Service division (where, by the way, the authors met), two years in Process and two years in Process Light Ends. A graduate of the University of Texas, he spends his hobby time with a movie camera.

Meet Our Authors. . .

Raymond and Socolofsky Write on Mutual Interest

L. Raymond and J. F. Socolofsky, "Designing Performance into Motor Oil," page 110.

Leonard Raymond and J. F. Socolofsky first got together in the Research and Development department of Socony-Vacuum Laboratories, a division of Socony-Vacuum Oil Company, Inc., Paulsboro, N. J. Their working together at the lab was a natural consequence in view of their mutual interest in fuels and lubricants development. Both have spent long years in this field.

Raymond is now chief automotive engineer in the Lubricating department at Socony's headquarters office in New York. He first joined the Research and Development department at Paulsboro in 1945, having previously been supervisor of the automotive laboratory of Tide Water Associated Oil Company. He has been associated with fuels and lubricants development and application since 1928, the year he received his M.A. degree from Columbia University. A native New Yorker, he is affiliated with several technical societies.

Socolofsky is now supervisor of the Lubricants section at Paulsboro, concerned with lubricating oil development. Since he joined Socony's Research and Development department in 1941, his work has included: (1) lube oil additive synthesis and evaluation, (2) lube oil refining studies, and (3) fuel and lube product development and utilization. Born at Marion, Kan., he has a B.S. degree in chemistry from the University of Kansas. He also is a member of several technical societies.

Upson Converts Memo To Complete Article

F. A. Upson, "Field Welding Heavy Wall Vessels," page 117.

What started out as a memorandum has blossomed into a full-fledged, informative article. F. A. Upson's article was originally written as a memo to provide information to others at his company's refineries, but was rewritten in its present form at another's invitation—and most readers will be glad that the invitation came after reading the article.

Upson is head inspection engineer at Standard Oil Company (Indiana) at Whiting, Ind. Soon after getting a B.S.E. degree in mathematics from the University of Michigan College of Engineering in 1937, he joined Standard at the Whiting refinery. Since then he has matched wits with engineering development, design, administration, and inspection. It's not official yet, but Upson will probably turn over his present duties to another soon and start work as assistant chief engineer in the Process Engineering section of the Design division of Standard's General Engineering department.

An Ohioan from Akron, Upson has a remarkable hobby: trying to find enough time to indulge in hobbies.

Wagner Knows Answers To Compressor Problems

Errol R. Wagner, "How to Maintain Compressors," page 147.

Twenty years of working with gas engines have supplied Errol the answers to quite a few of the problems encountered in their operation and repair. As plant superintendent of Stanolind Oil and Gas Company's North Crowden, Texas, gasoline plant, he has become no less informed on their application to compressors.

Stanolind has been his field of operations since he attended South Dakota School of Mines and the University of Wyoming, where he mixed the study of petroleum engineering with the practice of pugilism. He doesn't say at which he had more success but some indications may be gotten from his choice of professions.

Since joining Stanolind at its Salt Creek, Wyo., field, he has been successively plant superintendent and then superintendent of the Salt Creek gasoline plant, superintendent of the Slaughter gasoline plant, near Sundown, Texas, plant superintendent at North Crowden, his present post.

His enthusiasm for sports, reflected in his boxing in college, finds an outlet today in his many fishing junkets, on which he takes a 16-foot boat which he built for the occasions.

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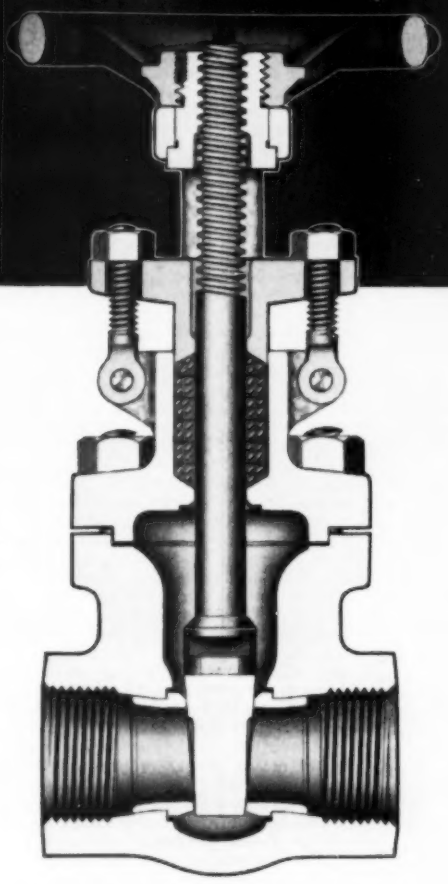

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Reviewing New Books . . .

Physics In Between

Modern Physics for Engineers, edited by Louis N. Ridenour, McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36. $7.50.

This work, edited by L. N. Ridenour, vice president, International Telemeter Corporation, and visiting professor of engineering, University of California, Los Angeles, is an outgrowth of an extension lecture course offered at UCLA in 1952-1953. Its aim is to give engineers and other technical men a brief account of some of the more interesting developments in the fundamental physical science which underlies all engineering.

Each chapter of this book is written by a recognized authority in the field that he treats. Together, the chapters represent a treatment of physical topics which is neither a collection of monographs for the specialist nor a popular account for the uniformed but rather something in between. The approach assumes a general familiarity with the methods and results of physical science but no specialized knowledge of the subjects treated.

Some of the topics treated: Relativity and the Foundations of Mechanics, Atomic Structure, Physics of Solid State, Magnetism, Microwave Spectroscopy and Nuclear Structure and Transmutation.

Scientific References

Stewart's Scientific Dictionary, Jeffrey R. Stewart, Stewart Research Laboratory, "Forest Gate" at Franconia, Alexandria, Va., $10.50. (Foreign order $12.50 in U. S. funds)

In approximately 800 pages, this reference volume defines the generally accepted terminology of the more widely used terms and materials of the chemical process industries. It covers such fields as plastics, soaps, detergents, industrial chemicals, petroleum, fungicides and insecticides.

The author, formerly special assistant to the Quartermaster General Department of Defense, reports that the book is the outgrowth of years of research and compilation at the Library of Congress and extensive correspondence with manufacturers, universities, libraries, research organizations and industrial consumers. Many terms included in the book are not to be found in any other dictionary. It's available on a 10-day "free" approval plan.

Government Instruments

Instrumentation, (Order No. 111464), Office of Technical Services, United States Department of Commerce, Room 6227, Commerce Building, Washington 25, D. C. $2.

To encourage American Industry to take advantage of the products of government-sponsored technical research, the Government Patents Board has issued this new volume which lists 775 government-owned inventions in the field of instrumentation, with a brief description of each invention.

The listings are classified under eight subgroups. These are: laboratory, scientific and engineering instruments; instruments for indicating, measuring and recording electrical quantities and characteristics; mechanical measuring and controlling instruments; optical instruments and lenses; surgical and medical instruments; X-ray and therapeutic apparatus; surgical and orthopedic appliances and supplies; and photographic equipment and supplies.

Ordinarily the inventions listed are available to the public on a royalty-free license basis. In addition to the brief description or abstract of the invention, each listing includes the patent number, the title of the invention, the name of the inventor and the government agency administering the patent.

This volume is the first of a series of seven on government-owned inventions scheduled for publication this year under the joint sponsorship of the U. S. Department of Commerce and the Small Business Administration.

Compressible Fluid Flow

The Dynamic and Thermodynamics of Compressible Fluid Flow, Volume II, Ascher H. Shapiro, The Ronald Press Company, 15 East 26th Street, New York 10. $16; two volume set: $30.

This publication makes available to engineers and applied mechanicians an up-to-date and comprehensive treatment of compressible fluid mechanics. It bases its discussion on a combination of theoretical treatment and empirical results. It provides a practical reference source directly useful for engineering purposes. The analytical developments comprise two types of treatments: those leading to design methods and those leading to exemplary methods.

Volume I, issued last October, provided the background for the subject and included chapters on one-dimensional flow, introduction to flow in two and three dimensions, subsonic flow and supersonic flow. Volume II continues the discussion of supersonic flow and discusses mixed flow, unsteady motion in one dimension, flow of real gases with viscosity and heat conductivity.

Sohio Recalls Packard to Help on Company History

Roy D. Packard, who recently retired after 50 years of service with The Standard Oil Company (Ohio), has been recalled to undertake the job of collecting and correlating historical information about the company. The information will be used to compile a chronological history of Sohio from 1911 to the present.

Packard was given the job because he has done much historical research in his delving into the life of Abraham Lincoln, a subject on which he is a recognized authority.

New Products

Successful Commercial Chemical Development, edited by H. M. Corley, John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. $7.75.

Prepared by committees of the Commercial Chemical Development Association and edited by H. M. Corley of Armour and Company, this 374-page book is intended to document "the important principles . . . in selecting promising new chemicals and rapidly developing them to the stage of economic importance." It discusses in detail each step in the development of a product, from the laboratory to commercial marketing, and outlines some of the career opportunities in this branch of the chemical industry.

Formerly, the book says, between 25 and 100 years elapsed between the discovery of a product and its general use. In contrast to this: "In the chemical industry alone, several thousand new products have been developed and commercially marketed since about 1940. The growth of a new product 'from test tube to tank car' now occurs in seven years, or five years, and sometimes even less. Not only has the rate of discovery been increased, but also the time required for evaluation of a discovery and its application to man's needs is being shortened." The book maintains this has happened because effective methods of commercial chemical development are coming into more general use.

After reviewing the growth of the chemical industry in the U. S. and the role of organized chemical development, the book describes steps involved in the evaluation and development of a new chemical. It points out the different objectives of the development group during each stage of a product's progress and offers practical advice on the problems to be overcome. A number of case histories of new products that were successful and unsuccessful are presented.

A number of chapters are devoted to other major phases of product development, including advertising, pricing, packaging and labeling. One chapter discusses the toxicology, safety and handling of new products.

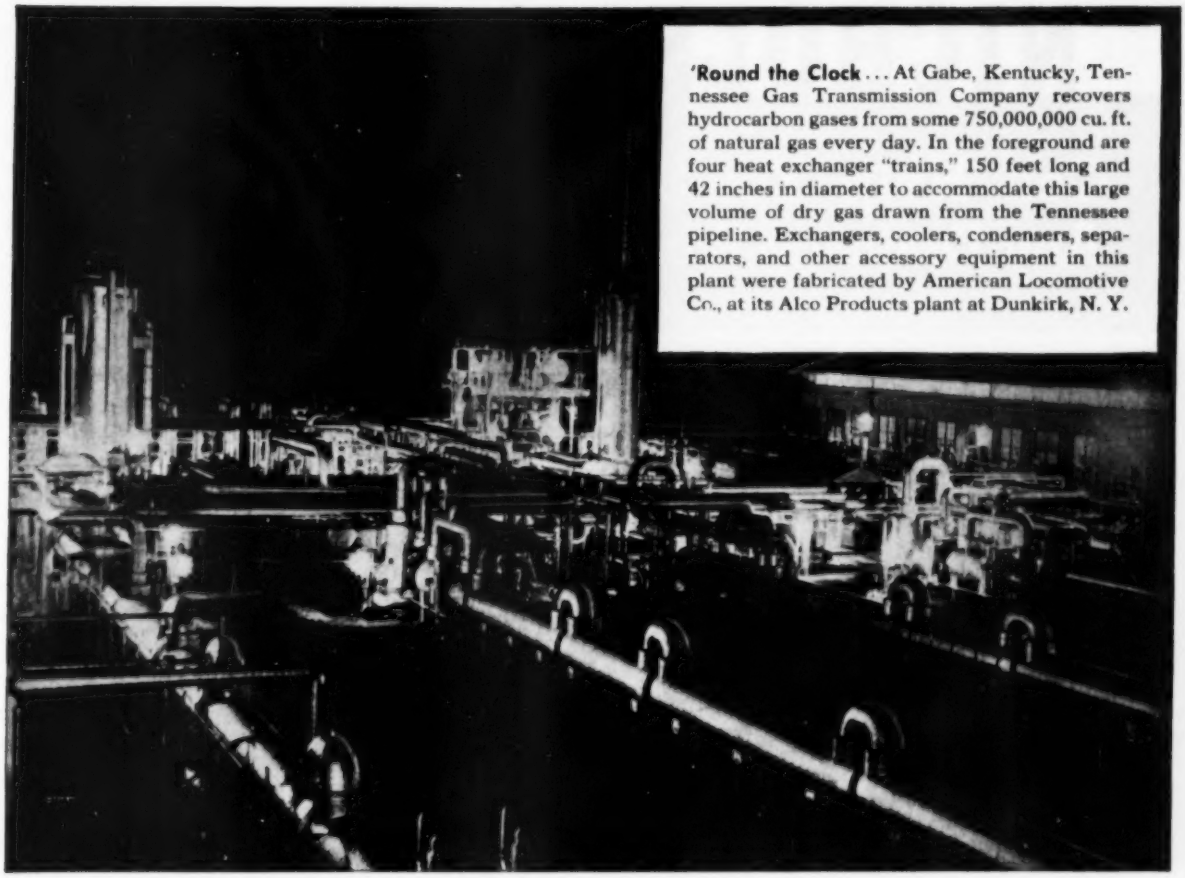
Besides serving as a handbook for the chemical industry, the book may also be useful to all people interested in the development of new products in other fields.

Flammable Liquids

Flammable Liquid Trade Name Index, NFPA No. 325A, National Fire Protection Association, Publications Department, 60 Batterymarch Street, Boston 10. $1.25, with discounts for quantity purchases.

Flash points of more than 2400 flammable liquid trade name products have been compiled and published in this 82-page booklet by National Fire Protection Association. Since the flash point of a liquid is a good indication of its relative flammability, the new listing is a usable aid in the safe storage and use of flammable liquids.

Previously, NFPA has published tabulations of fire hazard properties of flammable liquids identified only by their chemical names. This issue, they have included, in addition to the flash point, the principal users and the manufacturer of each product, and NFPA's source of information about it.



'Round the Clock... At Gabe, Kentucky, Tennessee Gas Transmission Company recovers hydrocarbon gases from some 750,000,000 cu. ft. of natural gas every day. In the foreground are four heat exchanger "trains," 150 feet long and 42 inches in diameter to accommodate this large volume of dry gas drawn from the Tennessee pipeline. Exchangers, coolers, condensers, separators, and other accessory equipment in this plant were fabricated by American Locomotive Co., at its Alco Products plant at Dunkirk, N. Y.

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Carbon influences low-temperature strength unfavorably, but nickel increases resistance of steel to sub-zero embrittlement while maintaining strength. That's why nickel steels with low carbon content prove especially useful for low-temperature equipment in the refinery and petrochemical fields.

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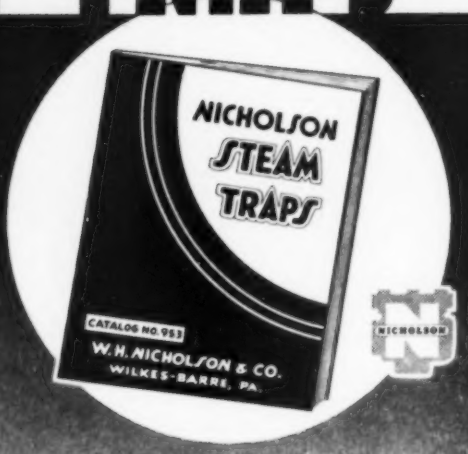

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Nicholson thermostatic bellows steam traps (at right), distinguished for their fast positive action, are suited for critical processing applications. They are widely specified for continuous production and where advanced-type quality controls are in use, due to the high even temperatures Nicholson units effect and their minimum maintenance time and costs. Other advantages: above-average drainage capacity; will not freeze in operation. Specify the trap in the proper size to fit piping requirements: in 0 to 200 lb. range use type A, D, AU or AHV; to 250 lbs., use type B or C in semi-steel construction; to 300 lbs., use type C in cast steel construction. Bellows of bronze, monel or stainless.

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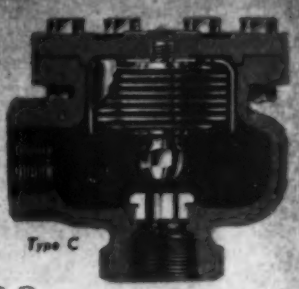
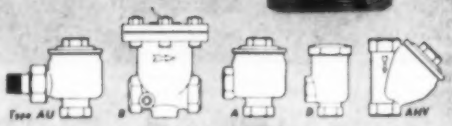
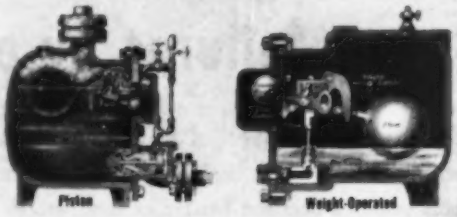




PISTON OR WEIGHT-OPERATED TRAPS

Nicholson piston-operated steam traps (right) have large capacity and are recommended wherever water is in volume; e.g., steam purifiers. Pressures: 2 to 650 lbs. Capacities: 12,500 to 552,000 lbs. Sizes: 1¼" to 2½".

Nicholson weight-operated traps are heavy-duty types for draining steam, air and gasoline from separators, process vessels, dry kilns, accumulators, intercoolers, etc. Pressures: 23 ranges, 0 to 1500 lbs. Capacities: 1295 to 11,700 lbs. Sizes: ½" to 2"



THERMOSTATIC METAL EXPANSION STEAM TRAPS

Nicholson expansion steam traps (right) require extremely low maintenance. Because they are readily adjusted to pass condensate at any point below 212°F, processing and refining plants have adopted these traps as low-cost temperature regulators on storage tanks which must be maintained at certain temperatures. Freeze-proof. Pressures: 0 to 250 lbs. Sizes: eight, ¼" to 2".

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How to Do It . . .

Blanket Insulation Cuts Turbine Downtime

You can use this type of insulation on turbine flanges and save hours on time required for inspection and repair.

ONE OF THE MOST annoying headaches faced in internal inspection of a turbine has been the excessive time involved in removing and replacing thermal insulation on horizontal flanges. In addition to the cost of the man-hours involved, as much as four days of much-needed operating capacity is lost while the turbine is down being insulated. A blanket method of turbine flange insulation has recently been developed which requires only a fraction of the time in removal and replacement consumed in the two most common techniques applied in the past.

One Common Method. The most widely used technique has been to cover the the entire turbine shell and flanges with a plastic insulation such as mineral wool cement in thicknesses from four to nine inches. In order to remove the upper turbine shell for inspection, the hardened insulating cement must be knocked away from both the nuts and bolts joining the flanges and the flanges themselves. After the turbine has been inspected, repaired and reassembled, several days are usually required to reapply the insulating cement—at considerable financial loss to the company.

Another Common Method. In the second most common method, the flanges are boxed in by sections of block insulation cut to size and wired in position. The cracks in the box structure are then filled with insulating cement and a cement finish is usually applied. The insulation is much easier to remove than in the first method but is equally difficult and time-consuming to replace. In addition, much of the insulating material is lost at each inspection.

The Blanket Method. The blanket method of turbine flange insulation (shown in the detailed cross-section, Figure 1) does not disturb the insulation at all but requires only the cutting and replacement of the wires. As in the other two insulating techniques, the turbine shell itself is covered with insulating cement (several layers of mineral wool cement separated by one-inch wire mesh in Figure 1). The cement covering is beveled down on both sides of the flange.

Blanket Application. A $\frac{3}{8}$-inch steel rod or cable is extended along each beveled edge parallel to the flange and is held in place by stainless steel wires from the threaded studs welded to the turbine shell to secure the 1-inch wire mesh. Mineral wool blankets, usually the 24 x 96-inch (standard) size, are cut and shaped to fit over the flange and are secured with soft tie wires to the steel rods on either side. The flange is insulated with two layers of blanket insulation secured in the same manner to two sets of rods. The inner layer of insulation has 1-inch wire mesh on both sides, while the outer layer is applied with wire mesh on the inside and a facing of expanded metal lath on the outside. Since the turbine shell will be covered with a sheet metal housing, no finish is installed over the blanket insulation.

As shown in Figure 1, the blankets may be further secured by tie wires through the insulation from nuts welded to the flange. These tie wires, as well as those holding the blanket edges together and to the steel rods, are spaced at roughly 4-inch intervals. Frequently, loose mineral wool insulation is packed in around the bolts to prevent axial air currents.

Blanket Thickness. Because blanket insulation is more efficient, smaller thicknesses are equally effective in the normal turbine operating range from 900 F. to 1100 F. Considering both relative thermal conductivity and average temperature at the flanges, the blanket thickness

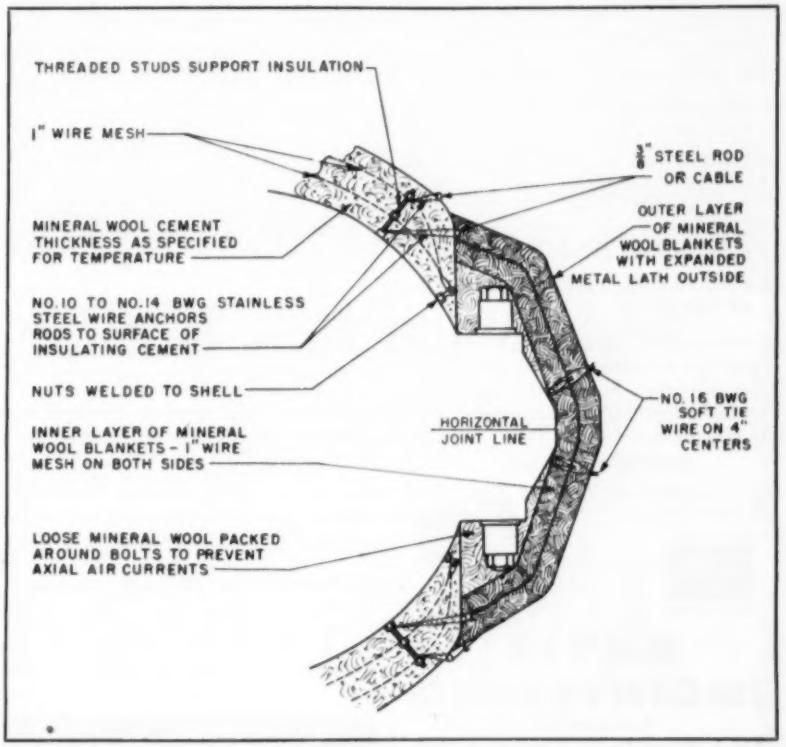
THREADED STUDS SUPPORT INSULATION
1" WIRE MESH
⅜" STEEL ROD OR CABLE
MINERAL WOOL CEMENT THICKNESS AS SPECIFIED FOR TEMPERATURE
OUTER LAYER OF MINERAL WOOL BLANKETS WITH EXPANDED METAL LATH OUTSIDE
NO.10 TO NO.14 BWG STAINLESS STEEL WIRE ANCHORS RODS TO SURFACE OF INSULATING CEMENT
NUTS WELDED TO SHELL
NO.16 BWG SOFT TIE WIRE ON 4" CENTERS
HORIZONTAL JOINT LINE
INNER LAYER OF MINERAL WOOL BLANKETS - 1" WIRE MESH ON BOTH SIDES
LOOSE MINERAL WOOL PACKED AROUND BOLTS TO PREVENT AXIAL AIR CURRENTS

Figure 1. Cross-section showing details of applying the blanket insulation to turbine flange.

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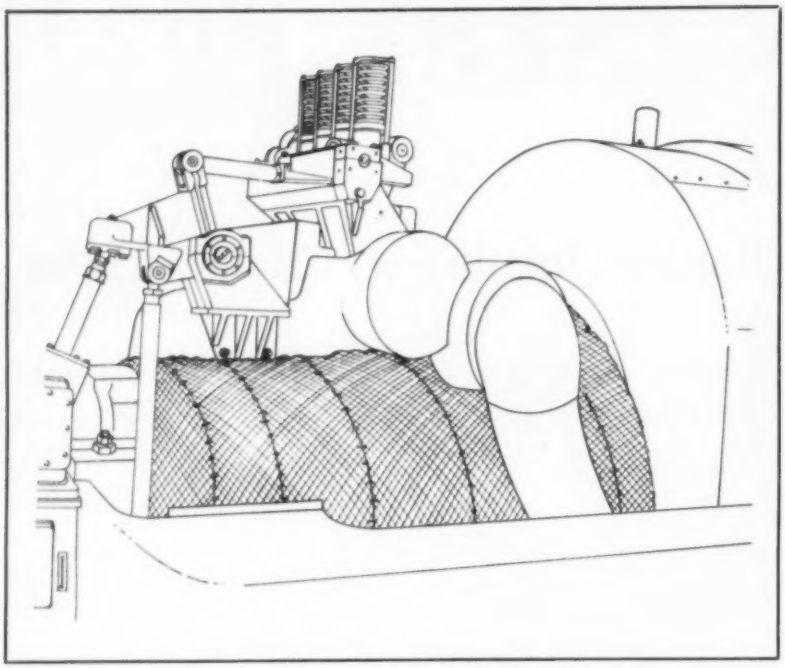


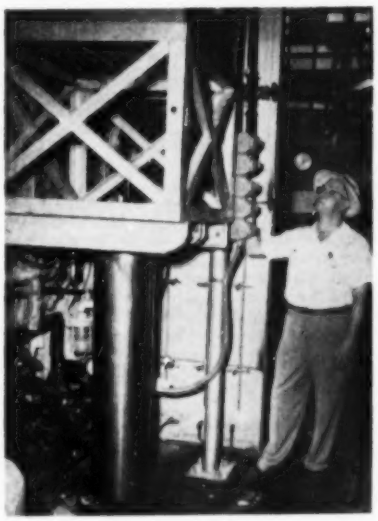
Figure 2. View of completed insulation job (cross-hatched area).

has been roughly assumed by several engineers as 60 percent of the specified maximum thickness of insulating cement on the hottest section of the turbine shell. For example, the 9-inch maximum cement thickness commonly specified would indicate a total blanket thickness of 5½-inches on the flanges.

Two layers of blanket insulation are normally used because a single layer as thick as 5½ inches would be too difficult to shape around the comparatively short flange section, since application must often be made in very confined space. The thickness is logically divided somewhat evenly between the two layers, for example a 2½-inch and a 3-inch layer for a total of 5½ inches. Because it is possible that standard galvanized wire might oxidize at the usual turbine operating temperatures, alloy wire mesh and even alloy tie wires have been specified to insure trouble-free service.

Finished Job. The drawing in Figure 2 shows the appearance of the turbine shell and flange after being completely insulated. The blankets are represented by the cross-hatched area (seams laced with wire) while the insulating cement above the blankets and on the large piping is shown white. In this case, the steel rods have been spaced wider apart than in Figure 1 so that the blanket insulation covers a greater part of the turbine shell on either side of the flange.

Ease in Inspection. The flange insulation is removed simply by cutting the tie wires to the steel rods and those attached through the insulation to the expanded metal lath facing on the outside. The blanket covering is then lifted off and stockpiled near the turbine in several large sections during the inspection period. After inspection is completed, new tie wires are simply attached to the rods and welded nuts and the blanket sections are wired back in place.



How to Do It . . .

Hydraulic Hoist Gives Research Workers a Lift

Oil researchers at the Baton Rouge, La., Esso Laboratories now get a lift in their work through the use of what is standard equipment in gasoline serv-

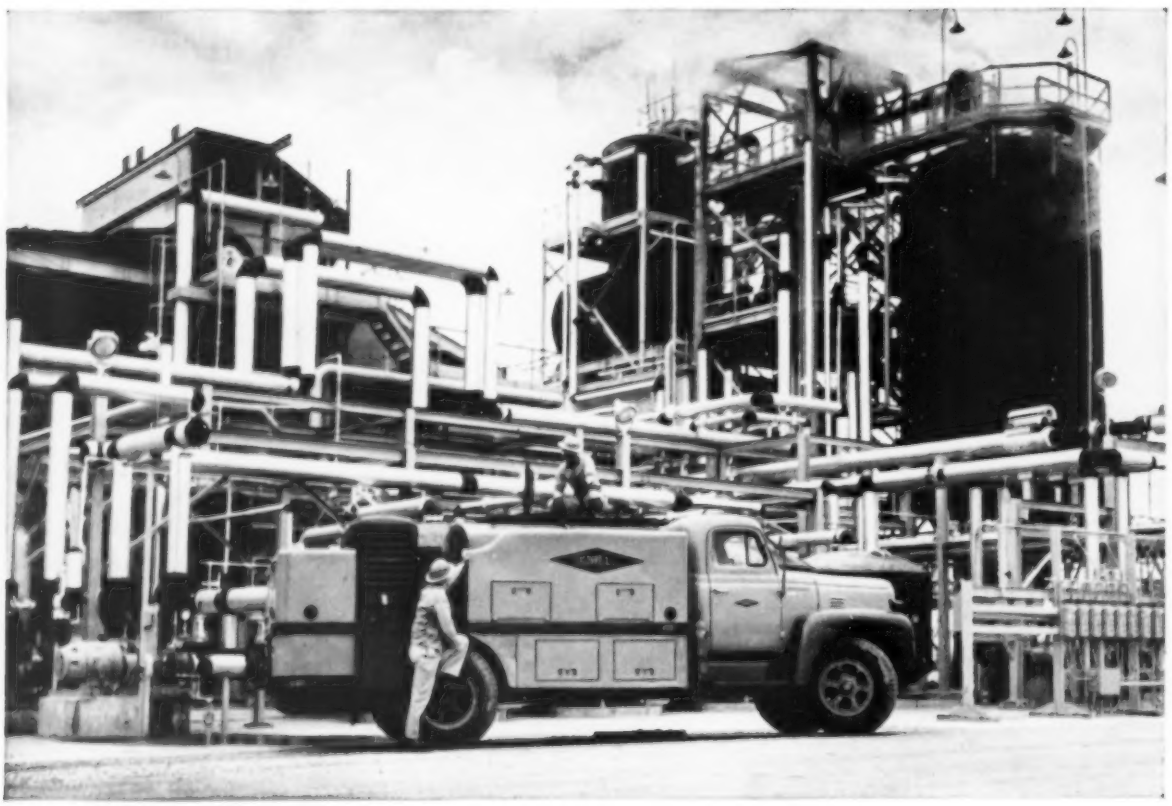
Sulfuric acid goes hungry here

Takes a pretty tough alloy to keep sulfuric acid on a starvation diet.

Yet these 8" gate valves of corrosion-resistant *Aloyco 20* do just that. They control the acid flow to four large absorbing towers in U.S. Industrial Chemicals' new 300-ton acid plant. Built by Leonard Construction Company at Tuscola, Illinois, it supplies acid for National Petro-Chemicals Corporation and the general market. *Aloyco 20* valves are standard throughout the plant for handling sulfuric acid.

Here, as in scores of industrial processing plants, Aloyco Valves speed the flow of chemical progress. Alloy Steel Products Co., Inc., 1301 West Elizabeth Avenue, Linden, New Jersey. 44

PLANT PROFITS UP $77,000 AFTER CHEMICAL CLEANING



DOWELL method of cleaning lines and process equipment cut plant turn-around time 22 days

Dowell was called to remove scale from pipe lines and process equipment in a plant where the semi-annual turn-around usually meant long, costly down-time. Dowell engineers used liquid solvents to do the job. It was not necessary to dismantle the equipment as the chemicals were introduced through regular connections. The job was done in far less time than ever before.

In fact, outage time for the year was reduced 22 days, representing an estimated $77,000 additional profit to the plant. As a result, Dowell Service was made a regular part of the plant's turn-around maintenance program.

The Dowell method of preventive maintenance cleaning with chemicals has helped to avoid the replacement of many miles of water and process lines and thousands of dollars worth of plant equipment. Chemical cleaning often uncovers weak points and helps to avoid later failures.

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How to Do It...

ice stations. They have installed a hydraulic hoist normally used to lift up cars for grease jobs.

In the pilot plant development of a new petroleum process, research engineers were faced with the problem of keeping part of the heavy equipment at temperatures over 1000 F. They hit on the idea of surrounding the equipment with a heavy kiln ordinarily sold to pottery makers. But the kiln was too heavy to be removed easily as was essential to the operation. So they bought a conventional filling station hoist and they now raise and lower the kiln at the flick of a switch. Only change was the substitution of a special type of steel for the familiar steel tracks.

Adjustable Clamp Firmly Anchors Process Piping

The illustration shows a highly serviceable hold-down clamp for use in process piping, particularly where such piping is subject to vibration shock. A U-shaped section is bent to conform to the contour of the pipe. Two small metal plates separate this clamp from the pipe itself. Then the U is tightened into place with the bolts shown. The U is fastened firmly to the ground by bolting to a base plate which is set in concrete.

Cash for Ideas

$10 is paid for each acceptable How to Do It contribution. Mail your ideas, with illustrations, to The Editor, PETROLEUM REFINER, P. O. Box 2608, Houston 1, Texas.

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DEKORON Metl-Cor® is a new plastic coated instrument line harness that is impervious to attack from even the most corrosive industrial atmospheres or weather conditions.

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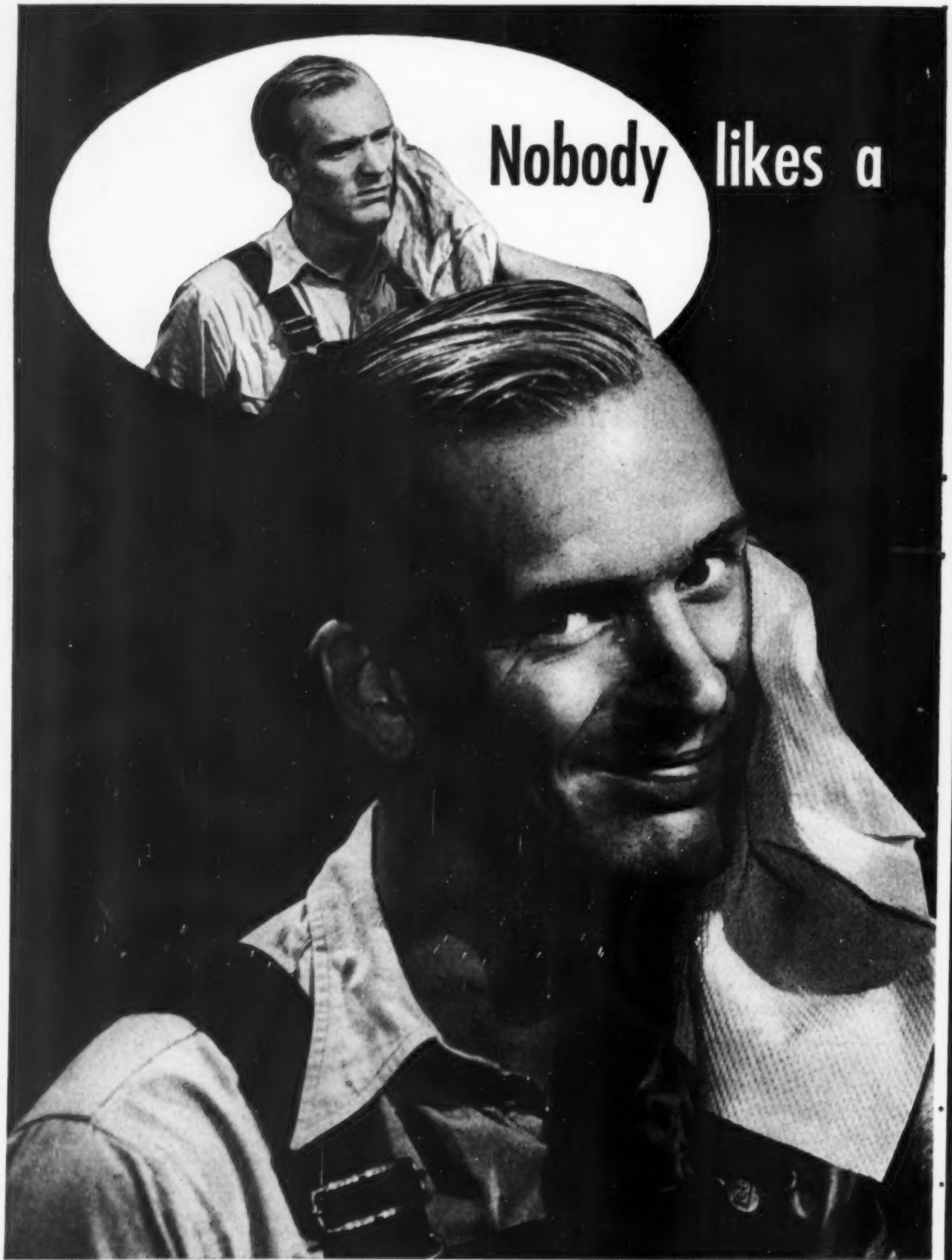
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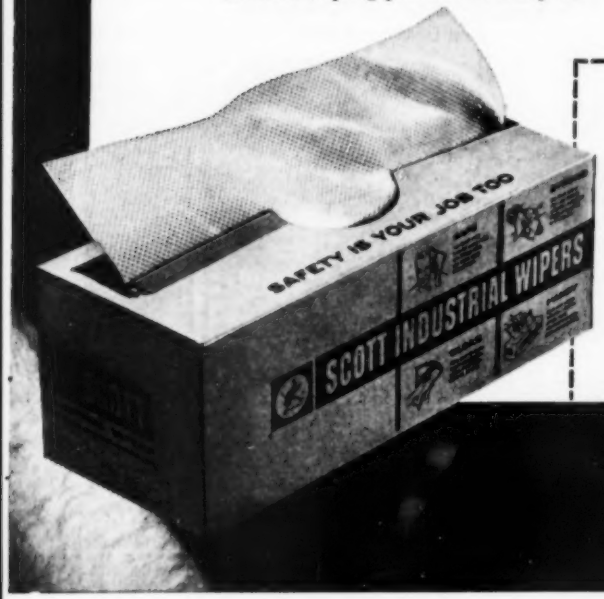

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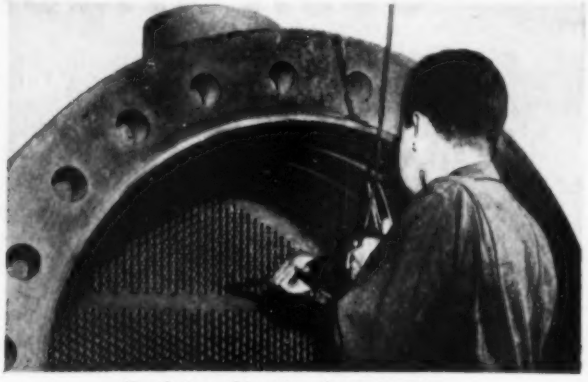

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Who's Building . . .

Shell Companies Plan Cardon and Curacao Units

Campania Shell de Venezuela, part of the Royal Dutch/Shell Group, has announced plans for the construction of a complete catalytic cracking plant at its Cardon, Venezuela, refinery. The unit, to have a capacity of 35,000 barrels a day, will produce high grades of aviation gasoline. The Cardon refinery already has facilities for high grade lube oil manufacture.

A catalytic cracking plant is also planned for refineries of N. V. Curacaosche Petroleum Industrie Maatschappij, another company in the Royal Dutch/Shell Group, at Curacao, Netherland Antilles.

Total cost of the installations at both refineries will be over $56 million. Operation is expected to begin by the end of 1957 or early 1958.

Chicago Corporation to Improve Champlin Refinery

Contract has been signed by Chicago Corporation of Fort Worth, Texas, with The M. W. Kellogg Company of Jersey City, N. J., for the construction of a Model B Orthoflow Fluid Catalytic Cracking unit at Chicago's Champlin refinery at Enid, Okla.

The new unit is part of a $4 million improvement program at Enid.

The catalytic cracker is expected to go on stream in about a year. Capacity of the gas-oil charging stock will be 9000 barrels a day.

The company has also signed a contract with The Southwestern Engineering Company, Los Angeles, to build a 5000-barrel-a-day Universal Oil Products Company Platformer. This unit will be completed within seven months.

India's New Refinery

Continued from Page 95

it supplies the demands of mounting industrialization and curbs imports, sorely needed because of dwindling foreign exchange.

Focal Point. Heart of the new refinery is a combination unit which integrates the normally separate processes of crude distillation, catalytic cracking and thermal reforming. The catalytic cracking equipment is the Model IV Catalytic Cracking unit.

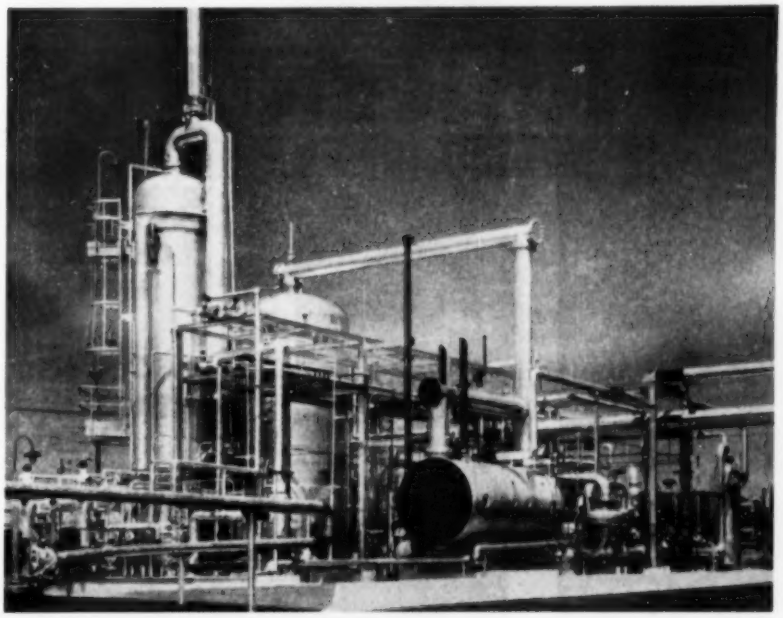
Of the refinery's annual output, 2,574,000 barrels will be motor gasoline, 1,144,000 barrels illuminating kerosene, 1,687,400 barrels diesel oil, 1,658,800 barrels industrial fuel oil, and 1,401,400 barrels bunker fuel oil.

Selection of Site. Numerous factors were considered before Trombay Island was chosen as the best site for the refinery. Among them: land values and methods of acquisition, atmospheric conditions, water and power supply, transportation and stocking facilities and geological data. After a thorough examination of pertinent technical factors, it was concluded that if a refinery had to be provided for the West Coast of India, where an overwhelmingly large percentage of petroleum products would be required, it would best be located at Bombay, as the city was the focal point for distribution on this coast. Moreover, Bombay was considered to be outside the earthquake area and the subsoil of Trombay Island, it was found, could withstand the heaviest loads required for the refinery.

The plant was built by Standard-Vacuum Refining Company of India, Ltd., a company in which private Indian capital will be offered a 25 percent preference-share interest.

Principal contractor for the construction project was The Lummus Company.

Other Stanvac Projects. The new plant is the second of three major refinery projects which by 1956 will double Standard-Vacuum's 1953 crude processing capacity (all in the Eastern Hemisphere) of 82,000 barrels a day. Other projects in the company's current expansion program include the Durban, South Africa, refinery, which went on stream in January with a crude processing rate of 15,600-barrels-a-day, and the enlargement of the Altona refinery, near Melbourne, Australia, from a 2000-barrel-a-day lubricating oil and asphalt plant into a 25,000-barrel-a-day fuel products refinery. The latter is scheduled for completion next year.



Lago Oil Adds Sulfur Recovery Unit—

This new 40-ton-a-day sulfur recovery plant is one of two units recently completed and put in operation at the Aruba, Netherlands West Indies, refinery of Lago Oil and Transport Company, Ltd., subsidiary of Standard Oil Company (New Jersey). The other unit is a gas purification plant. The Girdler Company, a Division of The National Cylinder Gas Company, performed all design, engineering, procurement and startup services. The M. W. Kellogg Company constructed the units.

Four-Company Group Makes Plans for Two Refineries

Plans for the proposed construction of two refineries and a giant 1800-mile-plus system of crude and product pipe lines in the Rocky Mountain-Arizona-New Mexico area have been completed. The plans were first announced last month by Bert Clardy, a Dallas, Texas, public relations man. (PETROLEUM REFINER, September, 1954, p. 339).

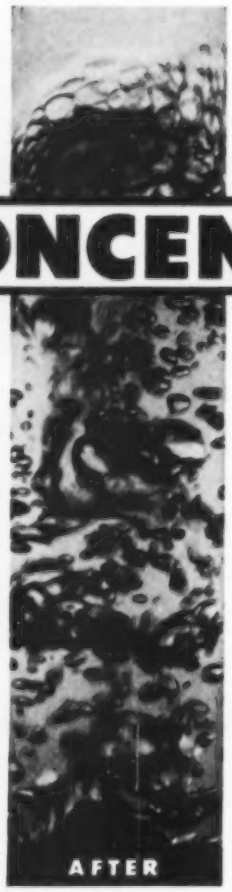
Four newly organized and related companies are involved in the undertaking. They are Ar-Mex Pipeline Company and Standard Pipeline Company, Inc., which will build the pipe lines, and Navajo Refineries and Arizona Refineries, which will build and operate a 10,000-barrel-a-day refinery at Albuquerque and a 25,000-barrel-a-day installation at Coolidge, Ariz., respectively.

Standard Pipeline is headed by Wiley F. Moore, President of all three of the other companies is Jack Frost, Dallas oil operator and rancher. Biggest stockholder in the latter three firms is John MacArthur, chairman of the board and president of Bankers Life & Casualty Company, Chicago.

Cost of the entire project is estimated at $100 million. A Frost representative said preliminary and final financing for the venture has been completed.

According to earlier reports, an option has been taken on Rocky Mountain crude totaling 35,000 barrels a day, the

Laboratory demonstration shows foaming of highly alkaline solution in glass test cylinder.



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Concentrol is supplied in liquid, powder or briquette form—can be fed either continuously or in slugs to boilers. Formulations of Concentrol can include organic sludge conditioning agents and other water treatment chemicals for boiler treatment as well as antifoam. Concentrol eliminates the need for costly pre-treatment of water and high blow-down rate. It is fast acting and resistant to hydrolysis or breakdown under normal boiler temperatures and pressures.

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Who's Building...

crude requirement of the two planned refineries. The option expires January 1, 1956, which means that most of the project must be completed and in operation by that time or the crude supply may be lost. Ebasco Services is handling design and engineering for both the refineries and the pipe lines.

Construction may start by the end of the year on the refineries, sizes and types of which have not yet been decided. Officials of the company said, however, that the plants would be modern, integrated installations. They said Ebasco will study the possibility of constructing an unspecified type of petrochemical plant near the Albuquerque refinery when it finishes the design and engineering work on the refineries.

Sohio Selects Site For New Petrochemical Plant

The new $17 million petrochemical manufacturing plant planned by The Standard Oil Company (Ohio) is to be built on the grounds of the company's refinery at Lima. Construction work is expected to begin next month and the new petrochemical plant will be in operation by November, 1955.

The M. W. Kellogg Company will build the anhydrous ammonia plant, the nitric acid plant and the solution plant. The urea plant is to be built by Arthur G. McKee and Company, which will also do the engineering work on the offsite facilities which include the office building and laboratory, warehouse, shop, boiler house, locker room and storage facilities.

A substantial portion of the raw material for the new plant will be by-product hydrogen from the new cataiytic reformer unit which is about to be put in operation at the Lima refinery. Remainder of the raw material will come from natural gas.

The Sohio petrochemical plant is expected to have a daily production capacity of 300 tons of anhydrous ammonia, of which almost 200 tons per day will be used in additional processing to make approximately 125 tons of urea, 60 tons of nitric acid and 200 tons of nitrogen solution per day. The major portion of Sohio's new products will be used as fertilizers, but a substantial share is expected to be supplied to industrial users.

Standard of Indiana and Sinclair Plan Ammonia Unit

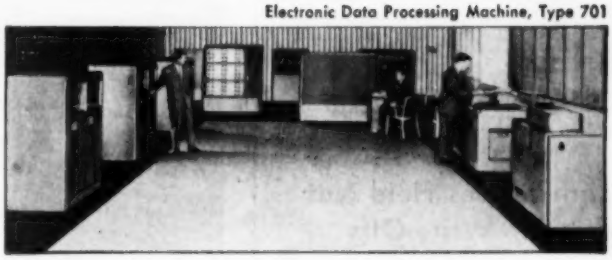
Standard Oil Company (Indiana) and Sinclair Refining Company have jointly announced plans for one of the Midwest's largest ammonia plants.

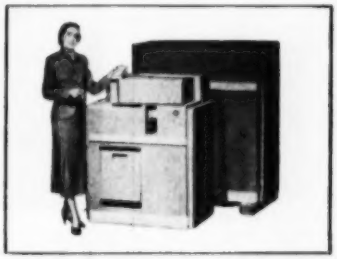
The plant will be built in Hammond, Ind., near Standard's Whiting refinery and Sinclair's East Chicago refinery. Both refineries will feed by-product hydrogen and other gases into the plant by pipe line. The hydrogen will be combined with nitrogen from the air to produce 300 tons a day of anhydrous ammonia. The plant will be the largest in the country producing anhydrous ammonia from by-product hydrogen. It will also be able to produce solutions of ammonia and ammonium nitrate.

A new company will be formed to own the plant. Standard, which will supervise construction and later oper-

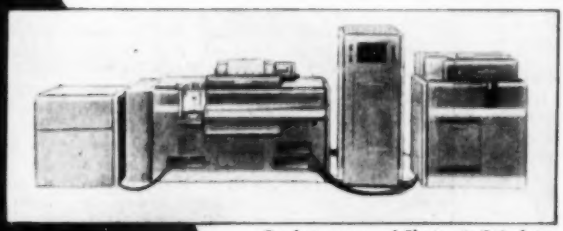
Magnetic Drum Data Processing Machine, Type 650

Electronic Data Processing Machine, Type 701

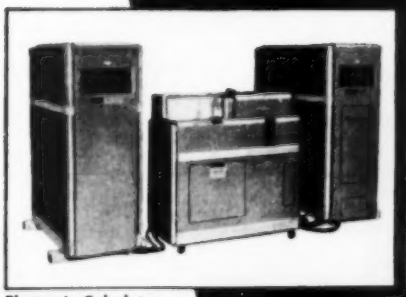




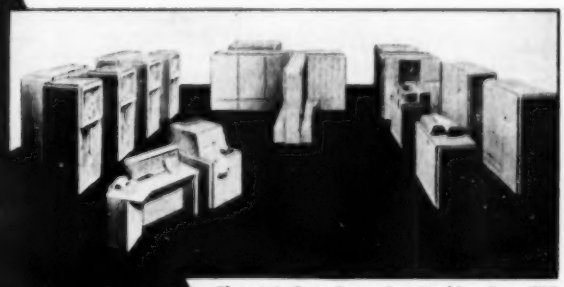
Electronic Calculator, Type 604



Card-programmed Electronic Calculator



Electronic Calculator, Type 607



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ate the plant, under contract with the new company, is obtaining bids from contractors. Site preparation is planned to start late this fall, with the beginning of construction tentatively planned for next spring. The target date for completion of construction and initial operation is early in 1956.

Modernizations Held Not Eligible for Write-Offs

Extension of the fast tax write-off program to include plant modernizations which do not include plant expansions has been turned down. Decision against the extension was apparently made by Defense Mobilization Board.

Chief arguments against inclusion of modernizations in the fast tax write-off program:

- Emphasis of the fast tax write-off program has been on expansion of the nation's output of essential products and the erection of new facilities and not the replacement of old ones.
- Further extension of the write-off benefits would result in lower government tax revenue during the next few years, which is opposed by Treasury Department.
- Permitting benefits for modernizations might encourage firms to stay where they are and modernize, which is contrary to one phase of the program which is to encourage plant dispersion.
- Liberalization of normal tax write-off regulations by Congress already gives some incentive for modernization.

Companies granted approval last month on applications for rapid tax write-off by the Office of Defense Mobilization were:

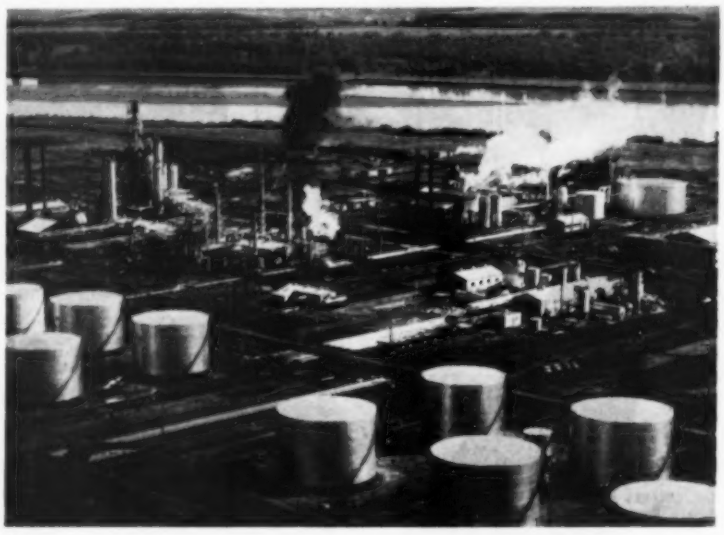
Esso Standard Oil Company, given approval for $7 million refining facilities planned for expansion of its Bayway, N. J., refinery. The project will include construction of a butane-propane splitter tower, a polymerization unit, de-ethanizer and auxiliary facilities. The rapid tax write-off rate will apply to 55 percent of $5,938,000 for basic facilities, and to 40 percent of $1,052,000 for auxiliary.

Bay Petroleum Corporation, on plans to construct a 1500-barrel-a-day catalytic reformer at its Chalmette, La., refinery, and moving of a topping and cracking unit from its McPherson, Kan., refinery to Chalmette. On the $1,158,325 project, the company was allowed to write-off $909,725 at 65 percent and $248,600 at 40 percent.

Humble Oil & Refining Company, on planned $805,000 additions to a hydroformer and other equipment at its Baytown, refinery. Accelerated depreciation rate will apply to 65 percent of $170,000, and 40 percent of $635,000.

Tide Water Boosts Plans

Tide water Associated Oil Company's proposed refinery to be constructed somewhere on the Eastern Seaboard to replace its Bayonne, N. J., refinery may have a capacity as high as 130,000 barrels a day. Previously announced capacity was 100,000 barrels a day. Site for the $75 million project has not been definitely selected.



Mandan Refinery Completed

Culminating planning, design and construction activities that began early in 1953, this new 30,000-barrel-a-day refinery of Standard Oil Company (Indiana) was dedicated early this month at Mandan, N. Dak.

Speakers at the dedication ceremonies, held at the refinery's site a mile and a half north of Mandan, included Gov. C. Norman Brunsdale of North Dakota, Dr. Robert E. Wilson, chairman of Indiana Standard, and A. W. Peake, president. Other members of the company's board took part in the dedication.

The new installation sits on a 900-acre site on the Missouri river and features a four-process combination unit which was completed just in time for the dedication. Facilities for the four processes—distillation, catalytic cracking, vapor recovery and polymerization—are on a three-acre rectangle. The crude distillation and fluid catalytic cracker sections are back to back, as are the vapor recovery and polymerization sections. Pumps in a single pump house handle the high temperature stocks between the former two sections; similarly a single pump house handles the light hydrocarbons between the latter two sections.

Prior to the official opening of the refinery, residents of Mandan and Bismarck, and even those in other parts of the state, joined in a four-day celebration of the event. The new refinery is being regarded as North Dakota's greatest industrial project to date. Before and after dedication of the facilities, trained refinery guides conducted visitors on tours of the plant.

Commonwealth Will Build Houdry Catalytic Units

Licensing arrangements have been concluded between Houdry Process Corporation and Commonwealth Oil Refining Company, Inc., for the construction of a 26,800-barrel-a-day Houdriflow catalytic cracking unit and a 3730-barrel-a-day Houdriformer. The units will be erected at the $24.5 million refinery Commonwealth is to build on Guayanilla Bay, about 15 miles west of Ponce on the southern coast of Puerto Rico.

The new refinery, with a nominal capacity of 23,000 barrels a day, is designed chiefly for the production of high octane gasolines from Venezuela and Middle East crudes. With the addition of the Houdriflow and Houdriforming, it will be capable of producing premium and aviation fuels.

The Houdriflow is designed for 75 percent conversion utilizing recycle operation. The Houdriformer will be a three reactor unit, equipped with suitable pre-testing facilities for processing high sulfur, low quality naphthas.

These units will be number 99 and 100 of the catalytic units licensed by Houdry since the company's founding in 1931. The Houdriflow will be the largest constructed to date outside the continental U. S.

Commonwealth Refining Company, Inc., was organized last year by Admiral Andrew F. Carter, who is serving as chairman of the board. Charles W. Saacke has been elected president of the company.

BP Benzin Dedicates New Platforming Unit

A new 5000-barrel-a-day platforming unit has been dedicated at the Hamburg-Finkenwerder, Germany, plant of BP Benzin- und Petroleum GmbH. The new unit, first of its kind on the European continent, is licensed by Universal Oil Products Company.

At the same time as the installation of the platformer, a new atmospheric distillation plant (Foster Wheeler) was

OPERATING COSTS... AND PLANT LOCATION

The ability of a company to make and maintain cost reduction is especially significant now that vigorous competition and a buyers' market are back.

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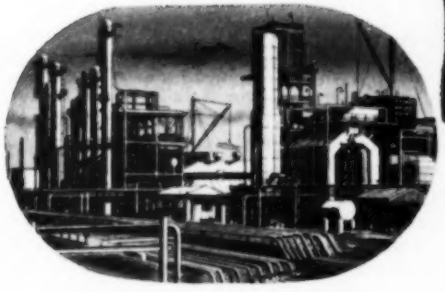

A large part of Brown & Root's activity has centered around the process industries in the design and construction of plants for heavy chemical, petroleum, petro-chemical and organic chemical fields.

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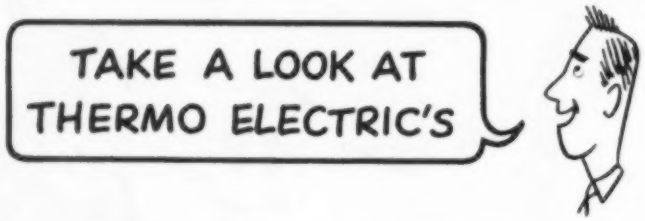
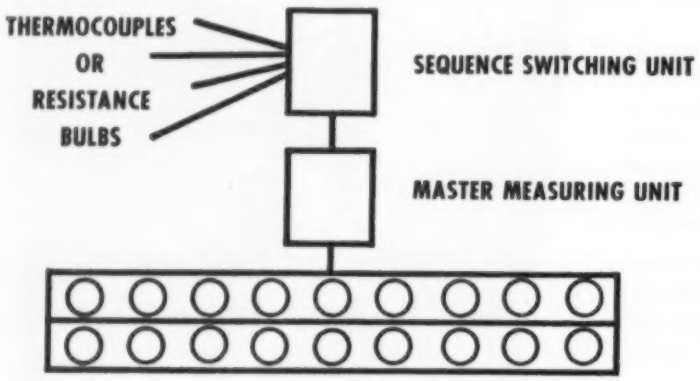


Thermo Electric's temperature monitoring system is composed of well-tested, standardized units. Each system consists of 4 basic parts:



The signal lamps indicate the condition at each measuring point as it is scanned. The master measuring unit can be pre-set easily to operate signal lamps at the high or low point you want. If the temperature is normal, a green light flashes—but if the temperature passes the danger-point you set, a red light goes on and an audible alarm is sounded. The alarm can be silenced by pressing a button, but the red light stays on until temperature returns to normal.

Different temperature monitoring systems can be built-up from standard units. Each Thermo Electric system can handle up to several hundred thermocouples (or resistance bulbs). Additional systems can be installed for greater capacity, or for high-speed scanning, or for monitoring various temperature points independently of one another.

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Pyrometers • Thermocouples • Protection Tubes • Quick-Coupling Connectors
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Who's Building . . .

installed. It has a capacity of about 11,000 barrels a day. The total capacity of the Finkenwerder plant, including a new 860-barrel-a-day bitumen blowing unit, amounts to approximately 25,000 barrels a day.

Construction Capsules . . .

Newport Industries, Inc., has added a Hygirtol hydrogen manufacturing plant to its Pensacola, Fla., facilities as part of its current expansion program. The Girdler Company, a division of National Cylinder Gas Company, performed all design, engineering, procurement and construction services.

E. I. du Pont de Nemours & Company, Inc., reportedly will build a new plant at Louisville, Ky., to produce "Freon-22" monochlorodifluoromethane.

General Aniline and Film Corporation plans to build the first commercial installation in this country for the manufacture of acetylene derivatives through high pressure techniques based on Reppe Chemistry. The Lummus Company will build the unit at Calvert City, Ky. It is scheduled to come on stream in late 1955.

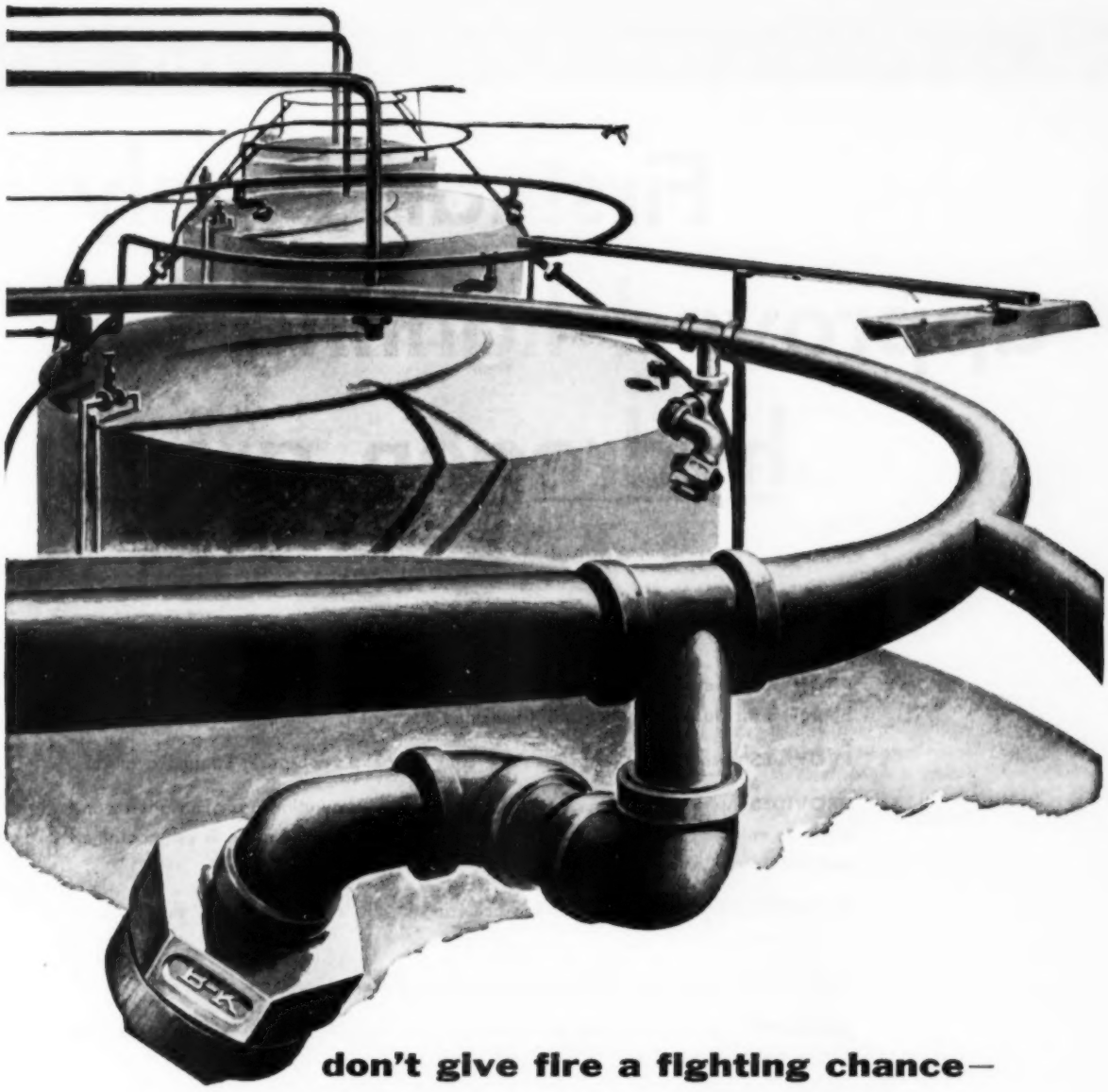
The Girdler Company, a division of National Cylinder Gas Company, will now build nitric acid plants using the E. I. du Pont de Nemours & Company process. Under the arrangements, Girdler will offer the plants to the chemical, fertilizer and explosives industries.

Danaho Refining Company, Houston, has begun work on a new platformer as part of a $2,671,000 expansion program under way at its Pettus, Texas, refinery. The unit is to be in operation within four months. The expansion program, which will boost the refinery's capacity from 4000 to 10,000 barrels of crude a day, includes construction of new catalytic cracking and polymerization units and revamping of existing units.

The Atlantic Refining Company has started operation of a new "Catformer" unit at its Port Arthur, Texas, refinery. The unit, built and designed by The H. K. Ferguson Company, utilizes a special catalyst developed by Atlantic and will convert naphtha into high grade gasoline.

Stanolind Oil and Gas Company is scheduled to begin regular operations of its Midland Farms gasoline plant located 26 miles north of Odessa, Texas, this month. Test runs were to have been held last month. Initially, the new plant will be run as a compression plant only, with a capacity of 10 Mmcf a day. Present Stanolind plans call for the future addition of absorption and distillation facilities at the plant, as well as an increase in capacity to 15 Mmcf a day.

Stanolind Oil and Gas will shut down its 7000-barrel-a-day Vivian, La., refinery next year and turn over the facilities to Pan Am Southern Corpora-



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A single Blaw-Knox Fog Nozzle, shooting its dense, quenching fog into the very heart of a starting fire, can accomplish more than several hose streams each having ten times its capacity.

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Why not let a Blaw-Knox Fire Protection Engineer study your needs and submit a cost estimate and preliminary layout?

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First and only approved lighting for hydrogen areas*

PROVIDES Underwriters' Laboratories approval for all hazardous areas; only units approved for class I, groups A & B. (acetylene, hydrogen, manufactured gas)

PROVIDES absolute, not relative safety. Only fully explosion-proof lighting available.

PROVIDES interior air pressure 15 psi greater than surrounding gas atmospheres and prevents entrance of any gas, paint vapors, dusts, etc. Air pressure is self-contained and lasts life of lamp.

ELIMINATES breathing and seepage occurring in all "explosion-proof" and "vapor-proof" units.

ELIMINATES explosions which occur by ignition of seeped-in gases, dusts, etc.

ELIMINATES explosions during moment of damage. Air Pressure units extinguish automatically at 3 ½ psi.

***P-101** 100 watt portable; air pressure type; air and water integrity; silicone lens gasket; rated 450°F; heat resistant and tempered lens; removable shield, 4000 hr. lamp; wt. 8½ lbs; first static-free cable available for portable floodlights.*
APPROVED CLASS I, GROUPS A, B, C, D

***PS-102** 200 watt portable on stand*

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- **Platforming**
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- **Houdriforming**
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and other petrochemicals involving any hydrogen

SL-200 *150, 200, 300 watt pendant fixture, air pressure type; air and water integrity; 2500 hr. lamp; rated 450°F; heat resistant and tempered lens; corrosion and weather-proof; max. temp. 80°C; silicone lens gasket*
APPROVED CLASS I, GROUPS A, B, C, D
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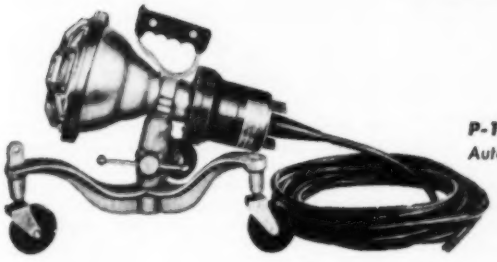
**Hydrogen classified Class I, Group B, (National Electric Code)*



P-101 *on dolly stand for Truck, Automotive, Airplane Maintenance, etc.*

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AIR PRESSURE LIGHTING DEPT.

Safe Lighting Inc.

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Who's Building...

tion. Both companies are subsidiaries of Standard Oil Company (Indiana). The refinery at Vivian is now obsolete.

Sure-Seal Corporation has begun operation of a new $2 million chemical dewaxing plant near Salt Lake City, Utah.

Brea Chemicals, Inc., subsidiary of Union Oil Company of California, has begun production of more than 250 tons of ammonia at its new $13 million ammonia plant near Brea, Calif. A carbon dioxide plant also is now in full production, producing 70 tons of dry ice per day. An ammonium phosphate plant is under construction within the present plant area.

Empresa Colombiana de Petroleos has completed construction of a 20,000-barrel-a-day refinery at Concon, Chile, near Valparaiso, at a cost of about $8 million. The plant was erected by the Pan American affiliate of The M. W. Kellogg Company.

Shell Refining & Marketing Company has added a new plant capable of producing 33,000 tons of sulfuric acid annually to its Stanlow refinery at Cheshire, England. This plant and a two-year old sulfur recovery plant at the refinery make the Stanlow facility the only refinery in the United Kingdom completely self-sufficient for supplies of sulfur and sulfuric acid.

Shell has begun construction of a platformer at its Shell Haven refinery on the north bank of the Thames Estuary in England. To cost approximately $7 million, the unit will have a capacity of some 5800 barrels a day. It is scheduled to be completed late next year.

N. V. de Bataafsche Petroleum Maatschappij, one of the associated companies in the Royal Dutch/Shell Group, will build a second catalytic cracking plant at its refinery at Pernis, The Netherlands. The unit will be of the fluid type and have a capacity of about 35,000 barrels a day. Construction is to begin immediately and will take about two years.

Ruhrchemie A. G. expects to complete construction of its new Oberhausen, West Germany, oil refinery shortly and to begin operation by next spring. The plant, to include parts of a former Fischer-Tropsch hydrogenation installation, will have an initial thruput of about 5370 barrels a day. It will include a catalytic cracking unit which uses a processing method licensed by Socony-Vacuum Oil Company.

Condor S.p.A. L'Industria Petrolifer e Chemica has raised the capacity of its Rho, Italy, refinery, near Milan, with the completion of new process units, including a 15,000-barrel-a-day catalytic cracking unit. Basic engineering was handled in the U. S. by Stone & Webster Engineering Corporation, with detailed engineering, procurement and construction management by the corporation's affiliate, E. B. Badger & Sons, Ltd.

Jordan and Syria are reported to have received approval on a loan of $2.5 million from the International Bank for Reconstruction and Development to finance a new oil refinery. The refinery will be built at Mafraq, Jordan, so as to be available to both countries. The Jordanian Reconstruction Council is handling Jordan's part in the project.

Iraqi government has completed specifications and tender documents for the country's first lubricating oil plant. The government plans to invite international firms to submit offers for its construction. The plant, to be built on the grounds of the Baghdad oil refinery at Dora, will have a capacity of 25,000 tons a year and cost about $8.4 million. It will be integrated into the main refinery, which is scheduled for completion by the summer of 1955.

Aurora Will Construct New Facilities at Detroit

Aurora Gasoline Company has formulated plans to build additional facilities at its Detroit refinery. The new facilities will cost approximately $4.5 million.

The company will enter the market with a new form of petroleum coke having unique properties and will also, for the first time in its history, market "bright sulfur" which is the bright yellow sulfur of top quality in the chemical field.

One of the new units to be built will be the first licensed Fluid Coker constructed in the world. It will employ a process developed by The Standard Oil Development Company, a subsidiary of Standard Oil Company (New Jersey).

The most expensive of the new units is a Unifiner, also the first unit of its kind to be built for the production of high quality furnace oils. This process is licensed jointly from Universal Oil Products Company and Union Oil Company of California. Design capacity of the unit is 7500 barrels per day.

A by-product of the Fluid Coker and the Unifiner will be converted in another process into "bright sulfur." This sulfur plant will be the first such unit built in that area of the U. S. The plant will produce 30 tons of sulfur a day.

A construction contract has been let to The Ralph M. Parsons Company, Los Angeles, for the above three units.

A second construction contract has been let to Procon, Inc., Des Plaines, Ill., for the immediate construction of a new fluid catalytic cracking unit at Detroit to increase the company's production of high octane gasolines. Immediate plans call for a high conversion operation charging 14,000 barrels of gas oil daily.

The completion date of these new units is expected to be early fall of 1955.

Four States-Western Will Build San Juan Refinery

A new 2000-barrel-a-day refinery is planned for the San Juan basin of New Mexico, about eight miles from Farmington, N. M. Four States-Western Oil Refining Company, a subsidiary of Western States Refining Company, Salt Lake City, will build the plant.

Construction of the $200,000 installation is scheduled to start immediately and is expected to be completed in about three months.

American Oil Preparing Yorktown Refinery Site

Contract for engineering, dredging and construction of pier facilities at the site of American Oil Company's new refinery on the York River near Yorktown, Va., has been awarded to Tidewater Construction Corporation of Norfolk, Va.

Engineering work is scheduled to start right away, with completion of the project expected in 12 to 15 months.

The contract the company has with Wiley Jackson Company for clearing of the area is on schedule and the job is approximately 70 percent complete. Bids have been requested from several contractors specializing in refinery design and construction for the operating facilities, and the general construction is expected to get under way early in 1955.

Indiana Standard Will Add Ultraforming Unit

An Ultraforming unit is to be added to the Sugar Creek, Mo., refinery of Standard Oil Company (Indiana). The Ralph M. Parsons Company, New York, has been selected as prime contractor and is expected to begin construction late this year.

The company has already begun preparing the site for the 14,000-barrel-a-day unit just south of the refinery's towering catalytic cracking unit. This work includes relocating pipes, connecting utility lines, and installing offsite piping for the new unit.

Construction is expected to be completed by mid-August, 1955, and the Ultraformer should start operating the following month.

The Ultraforming process, developed by Standard's researchers, uses a catalyst containing platinum to change low octane naptha into high octane gasoline.

Carbide and Carbon Nears Completion on Oxo Plant

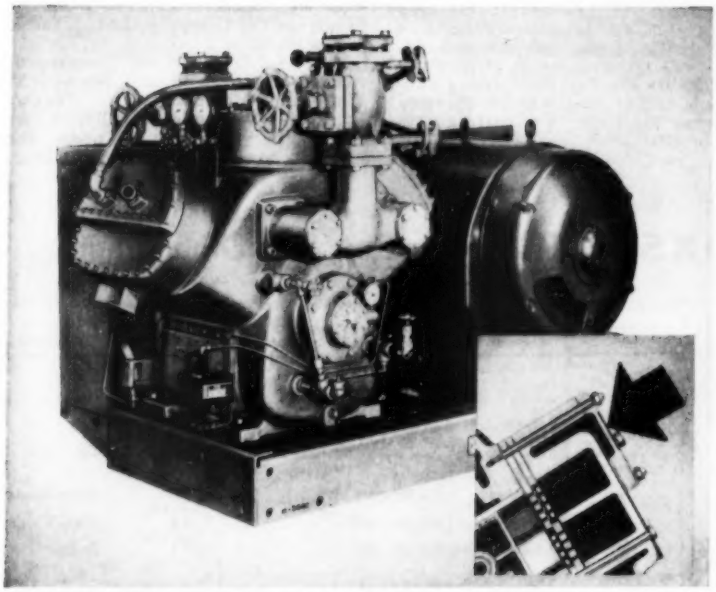
Construction of one of the largest units in the world employing the Oxo process for the synthesis of chemicals is nearing completion at the Texas City, Texas, plant of Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. The new unit will produce more than 60 million pounds of chemicals per year.

Using the extremely high pressure reactions of the Oxo process, the plant will add a large family of new alcohols, aldehydes and acids to the line of synthetic organic chemicals now produced on a commercial scale by Carbide and Carbon. At the present time commercial quantities of seven new Oxo chemicals are being produced in pilot plant facilities at the company's South Charleston, W. Va., plant. With the initial operation of the new unit, the manufacture of many of these will be transferred to Texas City. Production of iso-octyl alcohol, primary decyl alcohol and primary tridecyl alcohol is planned for initial operation of the unit which is now scheduled for late this month.

Egypt Plans Refinery

An Egyptian limited-liability company is to build and manage a new oil re-

Look at all the features of Worthington's new high-speed ammonia compressor



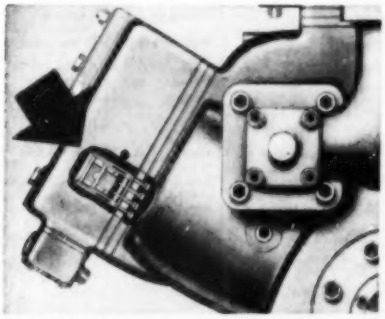
IMPROVED INTERNAL MANIFOLDING—cool suction gas completely surrounds the cylinder walls, providing longer valve life and increased overall efficiency. All passageways between suction discharge and shutoff valves are cast integrally within the crankcase, eliminating outboard fittings. Cross section shows water jacketing on one of the cylinders.

High operating efficiency and lighter weight make this modern unit the talk of the industry

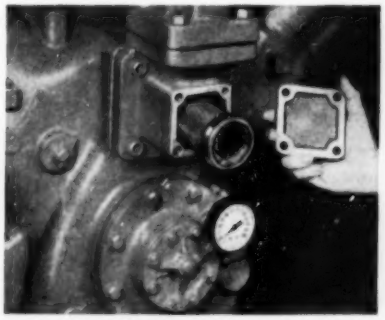
These lightweight, compact Worthington ammonia compressors have the same high operating efficiency and versatility as their lower speed counterparts.

Ranging in capacities from 18 to 150 tons, the new units can be used as high-stage or booster machines.

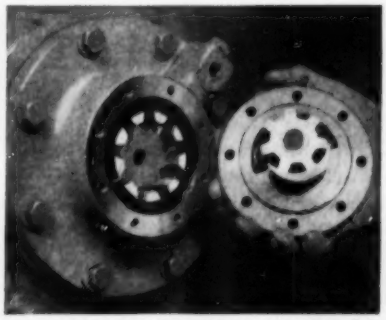
Get in touch with your nearest Worthington district office for more facts about these rugged compressors. Or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.3.56, Holyoke, Mass.



ELECTRIC UNLOADING—a new achievement in variable capacity control. You can start compressor with a normal torque motor; power consumption is automatically balanced against load. Separate unloader units allow easy maintenance . . . no oil or gas pressure lines to worry about.



NEW SUCTION MANIFOLD, with cover plate over suction strainer inlet, allows easy removal of the suction gas strainer for cleaning, without disturbing any of the pipes, valves or other parts. The strainer is unique in that it fits entirely within the crankcase manifold, requiring no additional space.



NEW FORCE-FEED LUBRICATION SYSTEM—full pressure, positive lubrication, regardless of rotation. A new rotary oil pump, driven directly by the crankshaft, eliminates complicated and noisy gear trains. Oil is filtered through a strainer in the crankcase for protection of pump and other moving parts.

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A.3.56

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

Who's Building...

finery in the district of Mex, Alexandria, Egypt, according to Mohamed Abu Nosseir, deputy minister of commerce and industry. Societe Egyptienne des Petroles will contribute a large part of the necessary capital. A Societe Egyptienne spokesman said that building of the new refinery would lead to a reduction in petroleum prices in Alexandria.

Ucan Products Starts Up Delayed Coker at Duncan

The new 9000-barrel-a-day delayed coking unit constructed by Ucan Products Company at Sunray Oil Corporation's refinery at Duncan, Okla., has gone on stream. The unit upgrades residual oil into charging stock for Sunray's 25,000-barrel-a-day catalytic cracking unit and produces petroleum coke.

Completion of the 220-foot unit coincides with the completion of Sunray's new 5000-barrel-a-day Platforming unit. The new coking unit will be operated by Sunray for Ucan, a recently organized corporation in which Sunray has a 50 percent stock ownership.

New Fawley Refinery Belongs to Esso Petroleum

From information released by the British Information Service, the new oil refinery at Fawley, in Southern England, was wrongly identified in the August issue of PETROLEUM REFINER (p. 166). The refinery pictured was that of Esso Petroleum Company, Ltd.

Texaco on Stream With Largest Platforming Unit

The world's largest UOP Platforming unit, a 20,000-barrel-a-day giant, went on stream last month at the Port Arthur, Texas, refinery of The Texas Company. The Platformer is also the first in the world to be combined with a Unifining unit in the preparation of feed stock and is the first of nine Platformers contracted for by Texaco for its U. S. refineries. A tenth Platformer is being built at the Montreal, Quebec, refinery of McColl-Frontenac Oil Company, Ltd., a subsidiary of Texaco.

Universal Oil Products Company designed, engineered and licensed the Platforming-Unifining unit. Procon, Inc., built the entire installation. Another such Platformer is under construction at the Port Arthur refinery.

Construction Boxscore: Refineries and Other Plants...

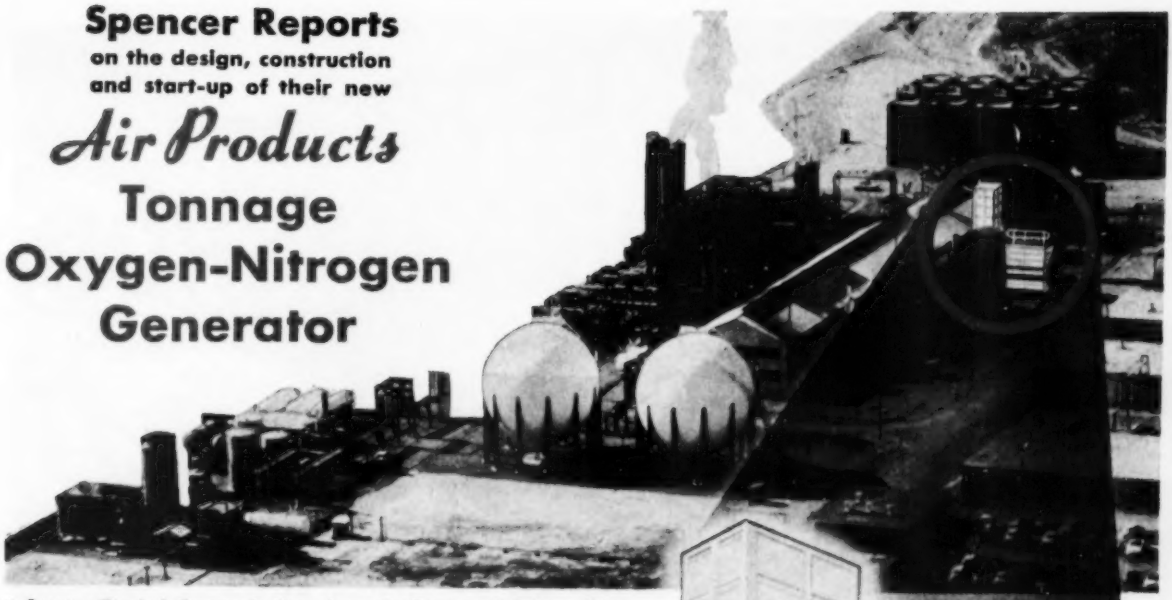
COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
EAST									
Allied Chem. & Dye Corp.	Hopewell, Va.	Inc. Ammonia Capacity	50,000 tons/yr.	.....	.....	1955	.....	Girdler	Girdler
Allied Chem. & Dye	Buffalo, N.Y.	Aromatic Fac.	.....	$6,940,000	PAD Certified	.....	.....	.....	.....
American Oil Co.	Yorktown, Va.	Refinery	35,000 bbls.	$25,000,000	Clearing Site	Spring, 1956	.....	.....	.....
Ashland Oil & Refining Co.	Catlettsburg, Ky.	Houdriformer	6,000 bbls.	.....	Engineering	June, 1955	Houdry	Cat. Constr.	Cat. Constr.
*Du Pont	Louisville, Ky.	"Freon-22"	.....	.....	Planned	.....	.....	.....	.....
Esso Standard Oil Co.	Baltimore, Md.	Fixed Bed Hydroformer	3,000 bbls.	.....	Announced	2nd Qtr., 1955	.....	SOD & Contractor	Foster Wheeler
Esso Standard Oil Co.	Baltimore, Md.	Hydrofinishing Equip.	17,000 bbls.	.....	Announced	2nd Qtr., 1955	.....	SOD & Contractor	Foster Wheeler
Esso Standard Oil Co.	Baltimore, Md.	Fluid Coker	10,000 bbls.	.....	Announced	2nd Qtr., 1955	.....	SOD & Contractor	Bechtel
Esso Standard	Everett, Mass.	Propane Plt.	870 bbls.	.....	Complete	.....	.....	S.O.D.	.....
Esso Standard	Linden, N.J.	Cat. Poty. Plt.	9,100 bbls.	.....	Announced	1st Qtr., 1955	.....	S.O.D., Braun	Braun
Esso Standard	Linden, N.J.	Crude Pipe Still	60,000 bbls.	.....	Complete	.....	.....	S.O.D., Kellogg	Kellogg
Esso Standard	Everett, Mass.	Asphalt Vacuum Tower	13,100 bbls.	.....	Under Constr.	3rd Qtr., 1954	S.O.D.	S.O.D.	.....
The Girdler Co.	Louisville, Ky.	Catalyst Plt.	.....	.....	Under Constr.	Dec., 1954	.....	Girdler	Girdler
B. F. Goodrich Chemical Co.	Calvert City, Ky.	Chemical Plt.	.....	$8,600,000	Under Constr.	1st Qtr., 1955	.....	Fluor	Fluor
Gulf Oil Corp.	Philadelphia	Sulfur Recovery	.....	$1,100,000	Engineering	2nd Qtr., 1955	.....	Parsons	Parsons
Hercules Powder Co.	Burlington, N.J.	Dimethyl Terephthalate Plt.	.....	.....	Under Constr.	March, 1955	.....	.....	.....
Monsanto Chemical Co.	Springfield, Mass.	Styrene Compounding	.....	$3,400,000	Under Constr.	1st Qtr., 1955	.....	Monsanto	Adams & Ruxton
Monsanto Chemical Co.	Springfield, Mass.	Research Fac.	.....	$1,000,000	Under Constr.	1st Qtr., 1955	.....	Monsanto	D. O'Connel
*Northern Chemical Industries	Searsport, Maine	Ammonia	125 tons		Engineering	.....	Texaco	Girdler	Girdler
		Nitric Acid	60 tons	$7,500,000	Engineering	.....	Du Pont	Girdler	Girdler
		Nitrogen Solutions	.....		Engineering	.....	.....	Girdler	Girdler
Sinclair Refining	Marcus Hook, Pa.	Cat. Reforming	16,000 bbls.	$14,000,000	.....	.....	.....	.....	Braun
Sinclair Refining Co.	Marcus Hook, Pa.	Para-Xylene Plt.	10 mln. lbs./yr.	$2,200,000	Under Constr.	1st Qtr., 1955	.....	Badger	Badger
Sun Oil Company	Marcus Hook, Pa.	Houdriflow Cat. Crker.	27,000 bbls.	$7,500,000	Under Constr.	March, 1955	Houdry	Houdry, Cat. Constr., Sun	Cat. Constr.
Sun Oil Company	Marcus Hook, Pa.	Houdriformer Cat. Unit	18,000 bbls.	$4,500,000	Under Constr.	April, 1955	Houdry	Sun, Houdry	Cat. Constr. Sun
Sun Oil Company	Marcus Hook, Pa.	Vacuum Unit	22,000 bbls.	$1,500,000	Design	March, 1955	.....	Sun, Cat. Constr.	Cat. Constr.
Texas Company	Westville, N.J.	Cat. Reforming	12,000 bbls.	.....	Under Constr.	4th Qtr., 1954	.....	U.O.P., Procon Staff	Procon, Others
Texas Company	Westville, N.J.	Alkylation Fac.	1,850 bbls.	.....	Under Constr.	4th Qtr., 1954	.....	Staff	Cat. Constr., Others
The Texas Company	Westville, N.J.	Platformer	12,000 bbls.	.....	Under Constr.	Dec., 1954	U.O.P.	Procon	Procon
*Tide Water Associated Oil	Eastern Seaboard	Refinery	100,000 bbls.	$75,000,000	Planning	.....	.....	Braun	.....
Union Carbide & Carbon Corp.	Leaksville, N.C.	Dynel Fiber Plt.	.....	$30,000,000	Planning	1955	.....	Staff	.....
MID-CONTINENT									
Allied Chemical & Dye	Cleveland, Ohio	Chemical Plt.	.....	$2,000,000	Under Constr.	1954	.....	Staff	M-C & S.
Amerada Pet. Corp.	Williston Basin, N.D.	Natural Gasoline Plt.	.....	$10,000,000	Planning	.....	.....	.....	.....
American Mineral Spirits Co.	Toledo, Ohio	Alkylation Unit (Sulfuric Acid)	.....	$2,500,000	Complete	.....	.....	Kellogg	Kellogg
Aurora Gasoline	Detroit, Mich.	Basic Refining	.....	$400,000	Announced	.....	.....	.....	.....
Bay Refining Corp.	Bay City, Mich.	Cat. Cracker	6,000 bbls.	$3,000,000	Under Constr.	Fall, 1954	Soc.-Vac.,U.O.P.	Sweco	Sweco
		Cat. Poly Auxiliary Equipment	300 bbls.						
The Carter Oil Co.	Billings, Mont.	Fluid Coking Unit	3,800 bbls.	.....	Under Constr.	Late 1954	Std. Oil Dev. Co.	.....	Fluor
Central Petroleum Co.	Coyle, Okla.	Gasoline Plt. Expansion:	.....	.....	Authorized	.....	.....	.....	.....
*Chicago Corp.	Enid, Okla.	Fluid Cat. Crker.	9,000 bbls.	$4,000,000	Planned	Nov., 1955	Kellogg	.....	Kellogg
		Platformer	5,000 bbls.		Planned	May, 1955	U.O.P.	.....	Sweco
Cities Service Oil Co., (Del.)	E. Chicago, Ind.	Topping Unit	30,000 bbls.	$2,000,000	Complete	.....	.....	McKee	McKee
		Fluid Hydroformer	12,780 bbls.	$4,000,000	Complete	.....	.....	Kellogg	Kellogg
Derby Oil	Wichita, Kans.	Platforming Unit	.....	$2,700,000	Under Constr.	.....	.....	.....	.....

* Table continued on page 187.

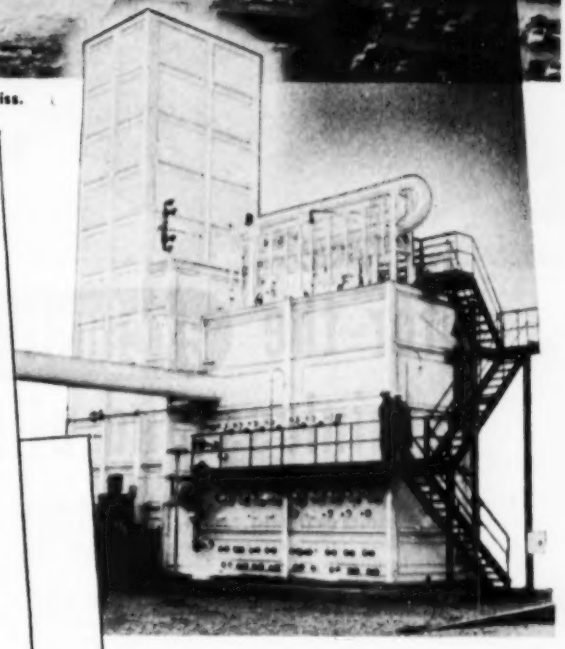
Spencer Reports

on the design, construction and start-up of their new

Air Products Tonnage Oxygen-Nitrogen Generator



• **Spencer Chemical Company's New Ammonia Plant at Vicksburg, Miss.**



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DWIGHT BUILDING
Kansas City, 5, Missouri

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Air Products, Incorporated
P. O. Box 538
Allentown, Pennsylvania

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"...It is particularly gratifying to us to see that the expanders and liquid oxygen pumps are both performing excellently."

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R. F. Brown
General Works Manager

"...I should like again to compliment you and your organization on the fine manner in which you cooperated with all of our Spencer people during the construction and start-up of the Vicksburg Unit. To my knowledge, it was a relationship which left little or nothing to be desired."

Very truly yours,

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Chief Engineer

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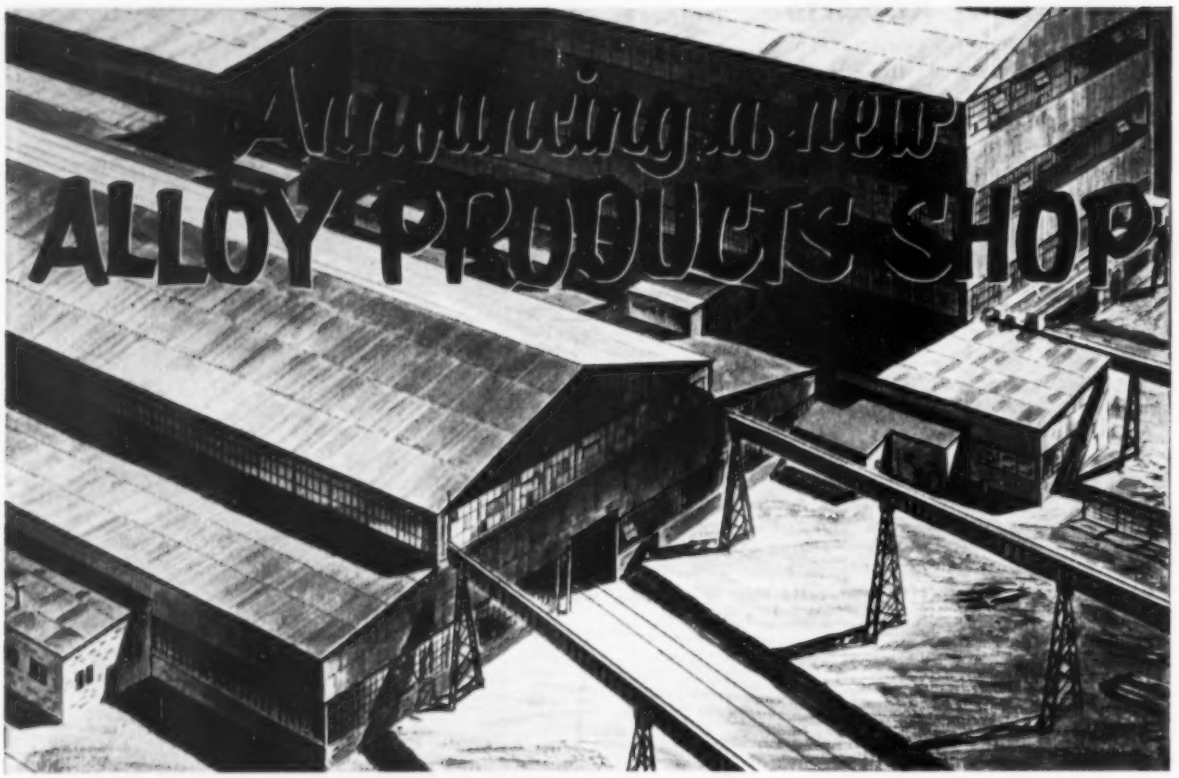

for the exclusive fabrication of stainless and alloy steel products

The new plant shown above, now finished and in operation, permits us to fabricate stainless and alloy steels in a shop completely segregated from our carbon steel operations.

Purity is Paramount—From an experience of many years in making *both* carbon and alloy equipment for industry, it has been demonstrated that the ideal set-up is—*segregation.* For top quality it is better that high-grade alloy steels be not exposed to contamination by tools and equipment used to make ordinary carbon steel products.

Sun Ship's new Alloy Products Shop, therefore, marks a distinct step forward in a great and growing field. Chemical plants, oil refineries, atomic energy plants, and many other types of industry are finding more and more uses for equipment boasting the special strengths and virtues contributed only by alloy steels.

Every Size and Type—In this new shop we are working with all of the 300 or 400 series of alloys, clad steels and aluminum; and are fabricating such products as pressure vessels, tanks, towers, troughs, autoclaves, reactors, hoppers, kettles, platework and machinery. All sizes and types are handled; and pieces too long for delivery by rail can be shipped direct by water from our own docks on the Delaware.

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ON THE DELAWARE (SINCE 1916) **CHESTER, PA.**

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REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Great Northern Oil Company	Pine Bend, St. Paul, Minn.	Crude Topping	25,000 bbls.					Fluor	Fluor
		TCC Unit	12,000 bbls.				Soc-Vac.	Fluor	Fluor
		Ultraformer	5,000 bbls.				Indiana-Standard	Fluor	Fluor
		Hydrodesulfurizer	11,000 bbls.	$20,000,000	Under Constr.	3rd Qtr., 1955	Indiana-Standard	Fluor	Fluor
		Cat. Poly.	900 bbls.				U.O.P.	Fluor	Fluor
		Delayed Coker	450 tons					Fluor	Fluor
Gulf Oil Corp.	Toledo, Ohio	Refinery Fac.; Platformer	10,000 bbls.		Under Constr.	Early, 1955	U.O.P.	Procon	Procon
Gulf Oil Corp.	Cincinnati, Ohio	Platforming Unit & Aux. Units	70,000 bbls.		Under Constr.	April, 1955	U.O.P.	Procon	Procon
Hercules Powder Co.	Birmingham, Ala.	Anhydrous Ammonia Plt.	45,000 tons/yr.		Planning	1955			
International Refineries	Wrenchall, Minn.	Petroleum Refining Fac.		$9,500,000	ODM Approved				
Kerr-McKee Industries, Inc.	Wynnewood, Okla.	Fluid Type Cat. Crker, Gas. Plt. & Cat. Poly. Unit	6,000 bbls. of Fresh Gas-Oil Feed	$2,500,000	Under Constr.	Nov., 1954	U.O.P.	Treco	Treco
Kerr-McGee Industries, Inc.	Wynnewood, Okla.	Offsite Fac.		$1,500,000	Under Constr.	Nov., 1954		Koch, Others	
Mid-Continent Petroleum Corp.	W. Tulsa, Okla.	Inc. in Alkylation Cap.	†500 bbls.		Under Constr.	Fall, 1954			
Mississippi Chemical	Yazoo City, Miss.	Ammonia Plt.	120 tons	$2,000,000	Under Constr.	Jan., 1955	L'Air Liquide	Girdler, MCC Staff	Girdler, MCC Staff
Mississippi Chemical	Yazoo City, Miss.	Nitric Acid Plt.	150 tons	$800,000	Complete		Du Pont	Chemical & Industrial Staff	Chemical & Industrial Staff
Mississippi Chemical	Yazoo City, Miss.	Prilled Ammonium Nitrate	400 tons	$750,000	Complete				
Mississippi River Fuel Corp.	Crystal City, Mo.	Petrochem. Plt. Ammonia & Nitrates	200 tons	$15,000,000	Under Constr.	Oct., 1955	Texaco Dev.	Fluor	Fluor
Missouri Farmers Association	Joplin, Mo.	Fertilizer Plt.	220 tons	$3,500,000	Under Constr.	1954		Dorr Co.	M-C & S.
Naph-Sol Refining Co.	Muskegon, Mich.	Cat. Reformer	6,000 bbls.		Planned				
National Distillers Products	Tuscola, Ill.	Synthetic Ammonia Plt.	30,000 tons/yr.	$7,000,000	Under Constr.	End 1954		Kellogg	Kellogg
National Petro-Chemicals	Tuscola, Ill.	Polyethylene Facilities	25 million lbs./year		Under Constr.	Spring, 1955	I.C.I.	Kellogg	Kellogg
Ohio Oil	Robinson, Ill.	Alkylation Unit	1,500 bbls.	$1,800,000	Complete		U.O.P.	Parsons	Parsons
Pana Refining Co.	Pana, Ill.	Modernization	†1,600 bbls.	$900,000					
Pana Refining	Pana, Ill.	Girbotol Unit			Under Constr.				Parker
Prime Oil Co.	Calumet City, Ill.	Refinery	15,000 bbls.	$10,000,000	Planned				
Shell Oil Co.	Wood River, Ill.	Offsite Fac.			Under Constr.			Fluor	Fluor
Shell Oil	Wood River, Ill.	Expansion and Improvement	†50,000 bbls.	$42,500,000	Under Constr.	4th Qtr., 1954		Shell	Foster Wheeler, Fluor & McKee
Shell Oil Company	Wood River, Ill.	Platforming Unit	16,000 bbls.		Complete		U.O.P.	U.O.P.	Procon
Signal Oil & Gas	Tioga, N.D.	Nat. Gaso. Plt.	50 Mmcf	$14,000,000	Complete			Pritchard	Brown & Root
Sinclair Refining	E. Chicago, Ind.	Barrel House Fac.		$2,700,000	Under Constr.	Summer, 1955			
Sinclair Refining	E. Chicago, Ind.	Power Plt. Addi		$570,000	Under Constr.	1954		Staff	Staff
Sinclair Refining	E. Chicago, Ind.	Gaso. Fract. Unit	20,000 bbls.	$1,300,000	Under Constr.	Fall, 1954		Graver	Graver
Sinclair Refining Co.	E. Chicago, Ind.	Cat. Reformer	16,000 bbls.	$13,000,000	Under Constr.	Spring, 1955			Braun
Skelly Oil	Velma, Okla.	Booster Station			Cancelled				
Skelly Oil Co.	El Dorado, Kan.	Cat. Reformer	7,500 bbls.		Under Constr.	1954	U.O.P.	Skelly	Skelly
Socony-Vacuum Oil Co.	Augusta, Kans.	Cat Reforming			Complete			Bechtel	Bechtel
Socony-Vacuum	E. St. Louis, Ill.	Alky. Expan.	775 bbls.	$260,000	Complete			Soc-Vac.	Soc-Vac.
Socony-Vacuum	E. St. Louis, Ill.	TCC	15,000 bbls.		Complete		Soc-Vac.	Lummus	Lummus
Socony-Vacuum	E. St. Louis, Ill.	Cat. Poly.			Complete		Calif. Res.	Lummus	Lummus
Standard-Indiana	Wood River, Ill.	Ultraformer	8,000 bbls.		Under Constr.	Late 1954		Kellogg	Kellogg
Standard-Indiana	Mandan, N.D.	New Crude Ref.	30,000 bbls.		Under Constr.	Late 1954			Lummus
Standard-Indiana	Whiting, Ind.	Fluid Hydroformer	27,000 bbls.		Under Constr.	Jan., 1955		Kellogg	Kellogg
Standard-Indiana	Whiting, Ind.	Motor Oil Exp.	21,600 gals.		Under Constr.	Late, 1954			
Standard-Indiana	Whiting, Ind.	Crude Unit	55,000 bbls.		Planning	Early, 1956			
Standard-Indiana	Wood River, Ill.	Coking Unit	7,000 bbls.		Planning	Late 1955			
Standard-Indiana	Mandan, N.D.	Ultraformer	3,375 bbls.		Planning	Late 1956			
*Standard-Indiana	Sugar Creek, Mo.	Ultraformer	14,000 bbls.		Under Constr.	Mid-Aug., 1955			Parsons
*Standard-Indiana & Sinclair	Hammond, Ind.	Anhydrous Ammonia	300 tons		Planned	Early, 1956			
Standard Oil of N.D.	Grand Forks, N.D.	Refinery	2,000-2,500 bbls.		Planning				
*Standard Oil Company (Ohio)	Lima, Ohio	Petrochemical Plt: Anhydrous Ammonia	300 tons						
		Urea	300 tons						
		Nitric Acid	125 tons	$17,000,000	Constr. to Start Nov., 1954	Nov., 1955			Kellogg
		Nitrogen Solution	60 tons						
		Offsite Fac.	200 tons						McKee
Sun Oil Co.	Toledo, Ohio	Houdriflow Cat. Crker.	27,000 bbls.	$6,000,000	Under Constr.	Feb., 1955	Houdry	Houdry, Cat. Constr., Sun	Cat. Constr.
Sunray Oil	Duncan, Okla.	Coking Unit	9,000 bbls.	$4,000,000	Complete			Lummus	Lummus
The Texas Co.	Lawrenceville, Ill.	Cat. Reformer	13,631 bbls.		Under Constr.	2nd Qtr., 1955		U.O.P.	Lummus, Others
	Lawrenceville, Ill.	Alkylation Unit	2,253 bbls.		Under Constr.	2nd Qtr., 1955		Lummus, Others	
The Texas Co.	Tulsa, Okla.	Platform. Unit	9,000 bbls.		Under Constr.	3rd Qtr., 1955			
The Texas Co.	Lockport, Ill.	Platformer	10,854 bbls.		Under Constr.	3rd Qtr., 1955		Staff, U.O.P. and McKee	McKee
The Texas Co.	Lockport, Ill.	Alkylation Plt.	1,000 bbls.		Under Constr.	3rd Qtr., 1955		Staff	
Vulcan Asphalt Refining Co.	Cordova, Ala.	Relocation of Refinery	2,200 bbls.	$122,700	ODM Approved				
Warren Petroleum	Lindsay, Okla.	Nat. Gaso. Plt.			Under Constr.	1954		Gas Plt. Constr.	Gas Plt Constr.
Warren Petroleum	Maysville, Okla.	Nat. Gaso. Plt.			Under Constr.	1954		Gas Plt. Constr.	Gas Plt. Constr.
Warren Petroleum Co.	Lindsay, Okla.	Extrac. Fac.	2,126 bbls.	$2,271,340	Under Constr.	1954		Gas Plt. Constr.	Gas Plt. Constr.
Warren Petroleum Co.	Garvin County, Okla.	Distl. Plt.	3,643 bbls.	$2,786,390	Under Constr.	Jan., 1955		Gas Plt. Constr.	Gas Plt. Constr.
Warren Petroleum Co.	Maysville, Okla.	Extrac. Enlargement		$2,500,000	Under Constr.	Dec., 1955		Gas Plt. Constr.	Gas Plt. Constr.
SOUTHWEST									
Allied Chem. & Dye Corp.	Orange, Texas	Ethanolamines				1955			
American Cyanamid Company	New Orleans, La.	Anhydrous Ammonia Plt.	300 tons	$50,000,000	Under Constr.	1954		Chemico	Chemico

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
*Aviane Refining Co.	Freeport, Texas	Refinery: Crude Topping Vacuum Dist. Cat. Reform. Cat. Crker. Also Dehydrogenation & Alkylation Units	10,000 bbls. 10,000 bbls. 5,000 bbls. 2,000 bbls. 4,000 bbls.	.....	Planning	Mid-July, 1955	.....	Texas	.....
*Chillicothe Petrochemicals, Inc.	Chillicothe, Tex.	Petrochemical Plt.							
		Ammonia	180-200 tons	$12-14,000,000	Unconfirmed	.....	.....	.....	.....
		Urea	150 tons						
Cities Service Oil Co., et al	Seminole, Texas	Nat. Gas Plt.	55,000 gals.	.....	Under Constr.	Feb., 1955	.....	.....	Delta
Cities Service Oil Co.	Lake Charles La.	Alkylate Fac.	.....	.....	Complete	.....	.....	.....	Kellogg
Cities Service Oil Co.	Lake Charles La.	Reformate Fac.	.....	.....	Complete	.....	.....	.....	Kellogg
Columbian Carbon Co.	North Bend, La.	Carbon Black Plt.	60,000,000 lbs./yr.	.....	Under Constr.	Initial Unit Complete Nov., 1954; Entire Plt. Nov., 1955	.....	.....	.....
Commercial Solvents Corp.	Sterlington, La.	Nitroparaffins Fac.	.....	$5,000,000 (Incl. Peora, Ill.	Planned	4th Qtr., 1955	.....	Staff	.....
Commercial Solvents Corp.	Sterlington, La.	Methylamine Fac.	.....	$4,300,000	ODM Approved	.....	.....	.....	.....
Commercial Solvents Corp.	Sterlington, La.	Ammonia, Methanol, Ammonium Nitrate	Double Ammonia-Methanol	$20,000,000	Under Constr.	1954	.....	Staff	Ford, Bacon & Davis
Cons. Chem., Ind.	Baytown, Tex.	Alky. Sulfuric Acid-Regen. Plt. & Sulfur Burning Acid Plant	600 tons	$4,500,000	Under Constr.	July, 1955	.....	Chemico	Chemico
Cons. Chem., Ind.	Houston, Texas	Alky. Sulfur Acid-Regen. Plt.	400 tons	$3,500,000	Under Constr.	July, 1955	.....	Chemico	Chemico
Corpus Christi Refining Co.	Tucker, Texas	Modernization	.....	.....	Planned	.....	.....	.....	.....
Crown Central Petroleum Corp.	Houston Texas	Houdriformer	5,500 bbls.	$1,500,000	Under Constr.	1954	Houdry	Blaw-Knox	Blaw-Knox
Danaho Refining Co.	Pettus, Texas	TCC Cat Crker. w/Reform.	3,500 bbls.	$2,600,000	Under Constr.	3rd Qtr., 1955	Soc.-Vac.	Koch	.....
		Cat. Poly.	265 bbls.	.....	.....	.....	.....	.....	.....
		Crude Expan. Gas Conc.	7,500 bbls.	.....	.....	.....	.....	.....	.....
Danaho Refining Co.	Pettus, Texas	Platformer	1,000 bbls.	.....	Under Constr.	Dec., 1955	U.O.P.	Staff	Staff
Dow Chemical Co.	Velasco, Texas	Glycerin Unit, Polyethylene	.....	$18-20,000,000	Planned / Planned	Jan., 1956 / Aug., 1955	.....	.....	.....
Dow Chemical Co.	Freeport, Texas	Soda Ash Plt.	300 tons	$3,000,000	Under Constr.	1955	.....	.....	.....
Dow Chemical Co.	Freeport, Texas	Ethylene Dibromide	.....	$8,500,000	DPA Certified	.....	.....	.....	.....
Du Pont	Beaumont, Tex.	Methionine Plt.	.....	$4,000,000	Under Constr.	Late, 1954	.....	.....	.....
Eastern States Petroleum Co.	Houston, Texas	Coking Plt.	13,000 bbls.	$4,000,000	Projected	.....	.....	.....	.....
Eastern States Petroleum Co.	Houston, Texas	Desulfurizing Unit Naphtha Plt.	.....	$200,000	Complete	.....	.....	.....	.....
Esso Standard	Baton Rouge, La.	Fuel Products Expansion	60,000 bbls.	.....	Complete	.....	.....	S.O.D., Kellogg, Treco	Kellogg, Ref. Eng.
Esso Standard	Baton Rouge, La.	Fluid Hydroforming Unit	20,000 bbls.	.....	Announced	1st Qtr., 1955	.....	S.O.D., Braun	Braun
Ethyl Corp.	Baton Rouge,	15% Increase in Anti-Knock Compound Output	.....	.....	Under Constr.	Early, 1955	.....	.....	.....
Ethyl Corp.	Houston, Texas	15% Increase in Anti-Knock Compound Output	.....	.....	Under Constr.	Early, 1955	.....	.....	.....
D. D. Feldman Co.	Lake Arthur, La.	Petrochem. Plt.	.....	$843,000	Applied for certificate of necessity	.....	.....	.....	.....
Gulf Oil	Port Arthur, Texas	Platforming	29,000 bbls.	.....	Under Constr.	1st Qtr., 1955	U.O.P.	Fluor	Fluor
Gulf Oil	Port Arthur, Texas	Exp. Ethylene Fac.	3,000 Mmcf/yr.	.....	Under Constr.	1st Qtr., 1955	.....	S&W, Badger Div.	S&W, Badger Div.
Gulf Oil Co.	Port Arthur, Texas	Gas Purification Unit	.....	.....	Under Constr.	Dec., 1954	.....	Girdler	Girdler
Gulf Refining, Humble Oil & Refining, The Texas Co.	St. Landry Parish, La.	Cycling & Gasoline Plt.	.....	$10,000,000	Under Constr.	Late, 1954	.....	.....	.....
Gulf Refining	St. Landry Parish, La.	Nat. Gaso. Fac.	.....	$5,000,000	.....	2nd Qtr., 1955	.....	.....	.....
Gulf Oil Co.	Runnels Co., Texas	Fac. for Processing Nat. Gas	393 bbls.	$400,000	.....	4th Qtr., 1954	.....	.....	.....
Heyden Chemical & Monsanto Chemical	Texas City, Tex.	Methanol Plt.	1,600 bbls.	$8,000,000	Projected	Jan., 1955	.....	.....	.....
Humble & Consolidated Chemical Industries, Inc.	Baytown, Texas	Sulfuric Acid	.....	.....	Under Constr.	April, 1955	.....	.....	.....
Jefferson Chemical Co.	Port Neches, Texas	Inc. Ethanolamines Prod.	50% Increase	.....	Under Constr.	1954	.....	Jefferson Chem. Co.	Jefferson Chem. Co. by Sub-Contract
Koppers Co.	Port Arthur, Tex.	Polyethylene Plt.	.....	.....	Under Constr.	Mid 1955	.....	Koppers	Koppers
Llano Grande Corp.	Lehman, Texas	Gaso. Plt.	25 Mmcf	$5,000,000	Under Constr.	End, 1954	.....	Tellepsen, Petro-Chem.	Tellepsen, Petro-Chem.
Magnolia Petroleum	Beaumont, Tex.	Therm. Cat. Reforming	17,000 bbls.	$10,000,000	Under Constr.	Late, 1954	Soc.-Vac.	.....	Lummus
McBride Refining Co.	Port Brownsville, Texas	Ref. Expan.	†12,500 bbls.	$2,500,000	Planned	.....	.....	.....	.....
McMurrey Refining Co.	Tyler, Texas	Avia. Gaso. Plt.	.....	$3,000,000	Engineering	June, 1955	.....	Blaw-Knox, Kellogg	Blaw-Knox
McMurrey Refg. Co.	Port Brownsville, Texas	Ref. Expan.	†12,500 bbls.	Planned	.....	.....	.....	.....	Kellogg
Monsanto Chemical	Texas City, Tex.	Polyethylene Plt.	66,000,000 lbs./year	.....	Under Constr.	1st Qtr., 1955	.....	Monsanto	Farnsworth & Chambers
Pan American Refining Corp.	Texas City, Tex.	Methyl Mercaptan Plt.	5 million lbs./yr.	.....	Under Constr.	End, 1954	.....	.....	Rust
Pan American Ref.	Texas City, Tex.	Ultraforming	21,200 bbls.	.....	Under Constr.	Nov., 1954	.....	.....	Kellogg
Payne & Johnston, & B. G. Byars	Nolan County, Texas	Nat. Gaso. Plt.	8-10 Mmcf.	.....	Under Constr.	Dec., 1954	.....	.....	Gaso. Plt.
Petrolite Corp.	Sweeny, Texas	Pet. Ref.	.....	$25,809	DPA Certified	.....	.....	.....	.....
Petrolite	Destrehan, La.	Pet. Ref.	.....	$60,000	DPA Certified	.....	.....	.....	.....

■ Table continued on page 191.

BRIDGEPORT BRASS COMPANY

CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN

Bridgeport Brass Co. MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND. — IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

How Temperature Affects Condenser Tube Corrosion Rate

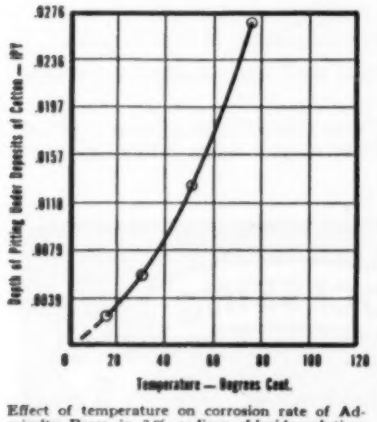
Heat speeds most chemical reactions —including condenser and heat exchanger tube corrosion. This is true on the cooling water side of condenser tubes as well as on the product side.

Tests on Admiralty Metal in 3% salt water solution showed that the pitting rate was eleven times greater at 75°C than at 18°C (see graph). Other tests have shown that the dezincification rate of Naval Brass and Muntz Metal in 2N sodium chloride solution goes up 6 and 11 times respectively when the temperature increases from 27° to 80°C. Red Brass doubles its corrosion rate over the same temperature range, while the rate for all three falls off to practically zero in contact with low temperature cooling brine.

Reasons for Hot Corrosion

Primarily, heat is energy which, when added to molecules, increases their activity and, as in the case of sodium chloride and hydrogen sulfide, their destructiveness. A temperature rise over a limited range in circulating water promotes organic activity and decomposition. This releases methane, hydrogen sulfide, ammonia and other sulfur and nitrogen compounds. Hydrogen sulfide will destroy a tube's protective film or patina of corrosion products and step up impingement corrosion, while ammonia may lead to stress corrosion cracking.

Air bubbles or debris clinging to the tube walls may set up local hot spots when stimulated by a higher temperature and rapidly produce corrosion pits. A high tube wall temperature may also promote penetration of the wall by intergranular corrosion which robs the tube of its mechanical strength.



Effect of temperature on corrosion rate of Admiralty Brass in 3% sodium chloride solution.

Corrective Measures

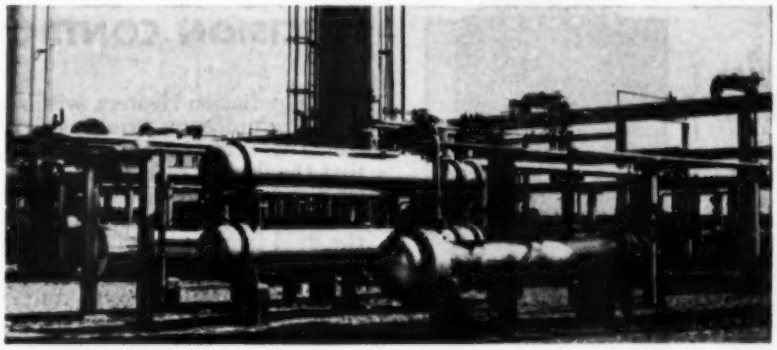
To offset high cooling water temperatures, the most effective remedies where applicable, are: (1) higher water velocities; (2) thorough tube cleaning; (3) chlorination to keep bio-activity down. The choice of tube alloy must be considered when strong chlorine is used, as strong chlorine solutions will severely attack copper and its alloys. The severity of attack will vary from one alloy to the next. When increasing water velocities, the properties of the alloy must also be considered. Arsenical Aluminum Brass, Arsenical Aluminum Bronze (Duronze IV) and the Cupro Nickel alloys are all recommended to withstand impingement corrosion at water velocities above 6 feet per second.

In general, low temperatures do not promote corrosion, although some media *are* corrosive at low temperatures. Refrigerants such as Freon and methyl chloride, and many beverages, chemicals, liquors or gases are good examples. Copper and its alloys have proved to be most satisfactory in low temperature operations—both in corrosion resistance and mechanical strength. These properties in many cases increase with lower temperatures.

Temperature has a marked effect on the corrosive activity of many media and can be instrumental in causing serious corrosion of condenser and heat exchanger tubes. For applications where temperature is a factor in corrosion, Bridgeport's Duplex Tubes offer hundreds of bi-metal, double-walled combinations to meet most double corrosive conditions.

One refinery, for example, used steel or red brass tubes for cooling propane gas containing an appreciable amount of hydrogen sulfide and some ammonia added to neutralize acidic constituents. It was found necessary to retube the heat exchangers every one or two years due to failure on the river water side. Replacement of the old tubes with a Duplex Tube of low-carbon steel lined with red brass resulted in an average life of 6 to 10 years.

In other applications of coolers handling nitrogen compounds such as ammonia, monoethanolamine or organic cyanide, Duplex Tubes with stainless or low-carbon steel to the product side and copper or a copper alloy to the cooling water side, gave excellent results.



Use Bridgeport Technical Service To Solve Your Tube Corrosion Problems

The effect of temperature on tube corrosion is only one of the many factors involved in selecting the best tube alloy or combination of alloys for condenser and heat exchanger applications.

Bridgeport Technical Service with its wealth of experience in solving tube corrosion problems can help you get longer tube life and greater efficiency in your equipment. Call your nearest Bridgeport Sales Office for more information on this free service—and also ask for your copy of Bridgeport's Condenser and Heat Exchanger Tube Handbook. (1925)

For more data on advertised products, use Readers' Service Cards, last page.

WESTVACO SELECTS SELAS

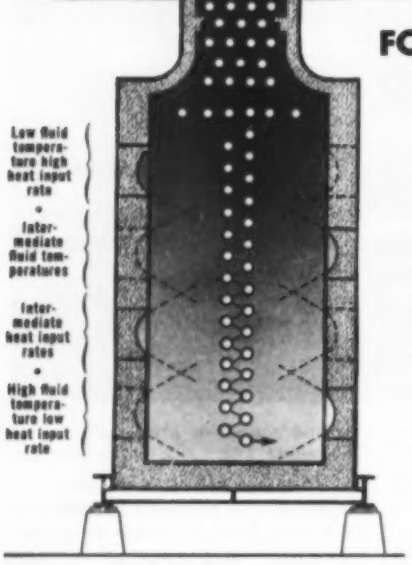

Low fluid temperature high heat input rate
Intermediate fluid temperatures
Intermediate heat input rates
High fluid temperature low heat input rate

Photo Courtesy Westvaco Chlor-Alkali Div., Food Machinery and Chemical Corp.

FOR MULTIPLE COIL HEATING WITH PRECISION CONTROL OF HEATING CURVE

Selas Gradiation Heaters, with radiant heat Zone Control, are ideally suited to processes requiring flexibility and precise temperature control. This control is achieved by manifolding the gas in such a manner that the flow to each horizontal row can be adjusted to the necessary level to maintain a predetermined tube wall temperature. Tube wall temperature remains constant over the entire radiant coil length and the fluid temperature is brought up to the precise degree of heat required in each zone. Results . . .

- Compact heating units are possible because multiple coils can be installed with absolute temperature control in a single radiant chamber. (Westvaco installation has four coils.)
- Flexibility in shaping the heating curve.
- Complete combustion with little or no excess air. (5% at Westvaco.)
- Prolonged tube life—lower max tube wall temperature minimizes corrosion rate.

Selas Gradiation Zone Control offers new possibilities in every petroleum refinery—large or small. Let us send you more information in our new 16 page booklet.

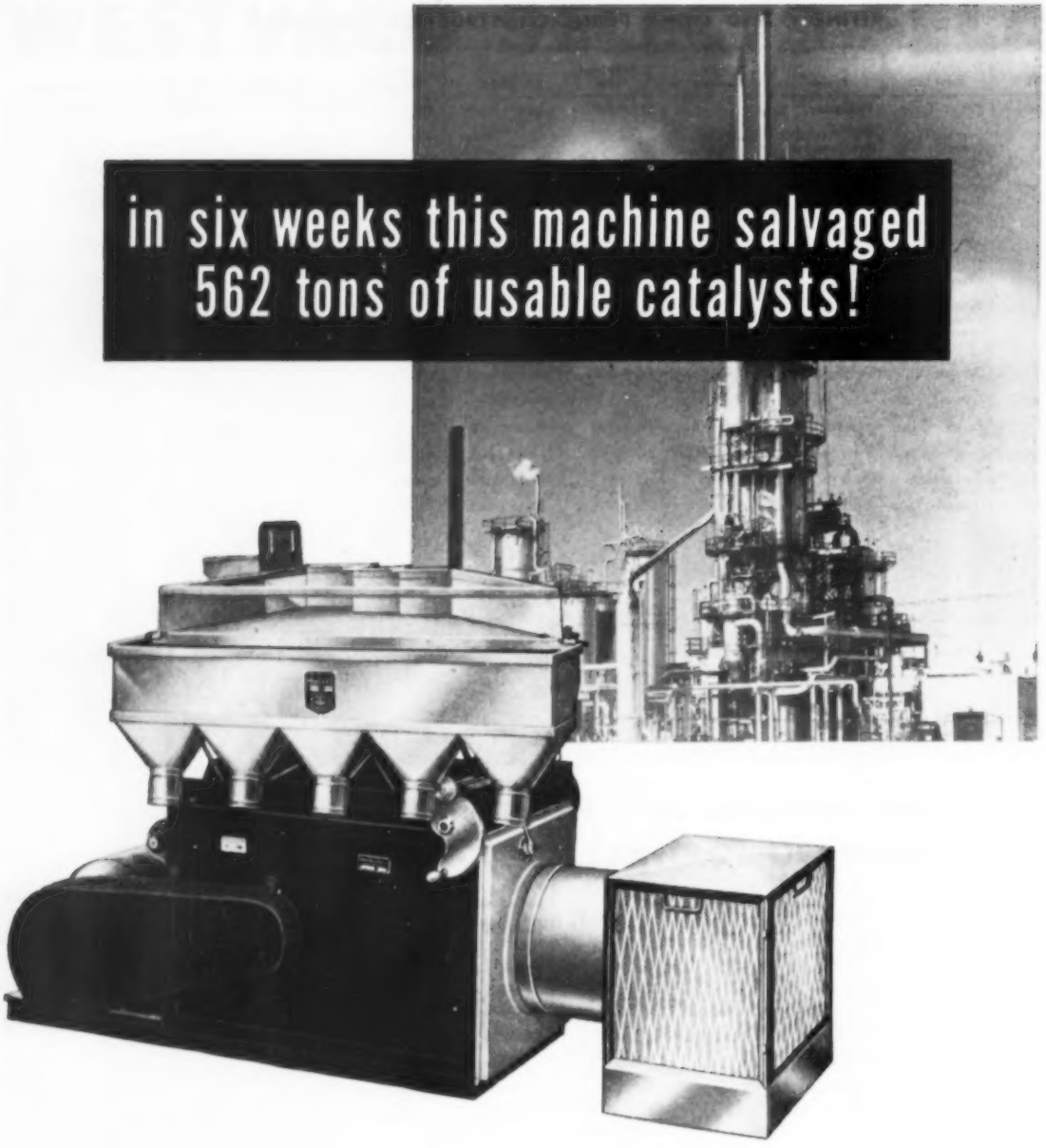
SELAS = FLUID PROCESSING

CORPORATION OF AMERICA • PHILADELPHIA 34, PA.

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Phillips Petroleum Co.	Borger, Texas	Platformer	.....	$2,200,000	Under Constr.	Dec., 1954	U.O.P.	Phillips	Phillips
Phillips Pet. Co.	Sweeny, Texas	UOP Platformer	16,000 bbls.	.....	Under Constr.	1954	U.O.P.	Procon	Procon
Premier Pet. Co.	Longview, Tex.	Cat. Poly. Plt.	.....	.....	Under Constr.	.....	.....	.....	.....
Shell Chemical Corp.	Houston Texas	Glycerine Plt. Extension	.....	.....	Under Constr.	4th Qtr., 1954	.....	Pioneer	Pioneer
*Shell Chem. Corp.	Houston, Texas	Epon Plt. Exp.	.....	.....	Under Constr.	2nd Qtr., 1955	.....	Lummus	Lummus
Shell Chemical Corp.	Norco, La.	Chlorohydrins for Glycerine & Epon Resins	.....	.....	Under Constr.	1st Qtr., 1955	.....	Fluor	Fluor
Shell Oil	Iowa, La.	Inc. Cap. Gaso. PH	†55 Mmcf	$600,000	Under Constr.	1st Qtr., 1955	.....	Olsen	Olsen
Sinclair Refining Co.	Houston, Texas	Sulfur Recov. Plt.	30 tons	$1,000,000	Under Constr.	Spring, 1955	.....	Parsons	Parsons
Spencer Chemical	Orange, Texas	Polyethylene Plt.	45,000,000 lbs./ year	$15,000,000	Under Constr.	Spring, 1955	I.C.I. of England	Staff, Hedrick Engineering	Quaker Valley Constr.
Stanolind Oil & Gas.	Brownsville, Texas	Recondition & Revamp	.....	.....	Under Constr.	.....	.....	Lummus	Lummus
Stonewall Gas Products Co.	Stonewall & Haskell Co., Texas	Gaso. Plt.	15,000 Mmcf	.....	Complete	.....	.....	.....	Bowden Constr. & Vaughan & Taylor
Sunray Oil Co.	Sarepta, La.	Cycling & Gasol Plt.	12 Mmcf.	$1,300,000	Under Constr.	1954	.....	Born Eng.	Born Eng.
Suntide Refining Co.	Corpus Christi, Texas	Alkyl. Expan.	To 70,000 bbls.	.....	Projected	.....	.....	.....	.....
Texas Eastman Co.	Longview, Tex.	Syn. Hard Wax Plt.	15,000,000 lbs./ yr.	$3,800,000	Under Constr.	.....	.....	.....	.....
Texas Eastman Co.	Longview, Tex.	Polyethylene Plt.	20,000,000 lbs./ yr.	$7,000,000	Under Constr.	4th Qtr., 1954	.....	.....	.....
The Texas Co.	Port Arthur, Texas	No. 2 Catalytic Reformer	20,000 bbls.	.....	Under Constr.	2nd Qtr., 1955	.....	Staff, U.O.P. and Others	Lummus and Others
The Texas Co.	Amarillo, Texas	Expan & Mod. Cat. Cracker, Cat. Reform., Atmos. Crude Pipe Still, Delayed Coker, Alky, Unit, Cat. Poly., Treating & LPG Handling Fac.	†7,500 bbls.	.....	Under Constr.	4th Qtr., 1954	.....	Kellogg, U.O.P. & Others	Kellogg & Others
The Texas Co.	El Paso, Texas	Expan. & Mod. Atmos. Crude Pipe Still, Cat. Reform., Cat. Cracker, Delayed Coker, Cat. Poly., Treating & LPG Handling Fac.	†5,400 bbls.	.....	Under Constr.	4th Qtr., 1954	.....	Foster Wheeler U.O.P., Others	Foster Wheeler & Others
Texas Gulf Producing Co.	Ector County, Texas	Gas Plt.	15 Mmcf	$1,750,000	Under Constr.	Dec., 1954	.....	Braun	Olsen
ROCKY MOUNTAIN									
*Arizona Refineries	Coolidge, Ariz.	Refinery	25,000 bbls/	Part of $100,000,000 Project	Planning	Jan., 1956	.....	Ebasco Services	.....
Atlantic Refining Co.	Lovington, N.M.	Natural Gas	25 Mmcf.	.....	Projected	.....	.....	.....	.....
Carter Oil Co.	Billings, Mont.	Fluid Cat Crker Expansion	15,000 bbls.	.....	Under Constr.	Late, 1954	.....	Staff	Braun
*Continental Oil, et al	Brush, Colo.	Nat. Gaso. Plt. & Gathering System	10 Mmcf	.....	Under Constr.	Nov., 1954	.....	.....	.....
Continental Sulphur & Phosphate Corp.	Thermopolis, Wyoming	Sulfur Extraction	50 tons/yr.	.....	Under Constr.	.....	American Sulfur & Refining	.....	Chemico
Cullen Group	Newcastle, Wyo.	Gas Plt.	.....	$4,500,000	Planned	.....	.....	.....	.....
Famarins Oil & Refining Co.	Monument, N. M.	Cat. Reforming Unit	650 bbls.	$375,000	Scheduled	Spring, 1955	U.O.P.	U.O.P.	Famarins Oil & Refining Co.
First National Petroleum Corp.	Jensen, Utah	Ref. Expan.	To 3,000 bbls.	.....	Planned	.....	.....	.....	.....
*Four States-Western Oil Refining Co.	Farmington, N. M.	Refinery	2,000 bbls.	$200,000	Under Constr.	End, 1954	.....	.....	.....
Jefferson Lake Sulphur Co.	Manderson, Wyo.	Sulfur Recov. Plt.	111 tons	$600,000	Under Constr.	Autumn, 1954	.....	Parsons	Parsons
*Navajo Refineries	Albuquerque, N. M.	Refinery	10,000 bbls.	Part of $100,000,000 Project	Planning	Jan., 1956	.....	Ebasco Services	.....
Ohio Oil Co.	West Sidney Field, Nebr.	Nat. Gaso. Plt.	12 Mmcf	.....	Under Constr.	Dec., 1954	.....	.....	Stearns-Roger
Salt Lake Chemical Co.	Salt Lake City, Utah	Synthetic Ammonia Plt.	120 tons of Ammonia 30 tons dry ice.	$7,800,000	Under Constr.	3rd Qtr., 1955	.....	Tears	Tears, Henry C. Beck Co.
Salt Lake Refining Co.	Salt Lake City, Utah	Fluid Cat. Crker	8,000 bbls.	$2,500,000	Under Constr.	April, 1955	.....	.....	Fluor
Shell Oil Co., et al.	Mt. Hope, Colo.	Gas Compression Plt.	4.5 Mmcf.	$650,000	Under Constr.	Complete	.....	Blaw-Knox	Blaw-Knox
Socony-Vacuum Oil Co., et al	Manderson, Wyo.	Gas Processing Plt.	.....	$1,500,000	Under Constr.	Nov., 1954	.....	Parsons	Parsons
Standard Oil (Ind.)	Casper, Wyo.	Ultraformer	3,375 bbls.	.....	Under Constr.	Late, 1954	.....	.....	Lummus
Union Oil Co. (Calif.)	Cut Bank, Mont.	Unifining Unit	100 bbls.	$100,000	Under Constr.	Late 1954	Union Oil	Parsons	Parsons
Utah Chemical Co.	Sanpete Valley, Utah	Ammonia Plt.	278 tons	$18,800,000	Planned	End, 1955	.....	.....	Cat. Constr.
Western States Refg.	Salt Lake City	Topping; Crker.	3,000/2,200 bbls.	$1,100,000	.....	.....	.....	.....	.....
WEST COAST									
Brea Chemicals, Inc.	Brea, Calif.	Nitric Acid & Ammonium Phosphate Plt.	.....	$2,500,000	Under Constr.	.....	.....	Braun	.....
Calstate Refg. Co.	Signal Hill, Calif.	Hyperformer Unit	1,100 bbls.	$300,000	Under Constr.	.....	Union Oil	.....	Calstate
Caminol	Hanford, Calif.	Petroleum Refining Fac.	.....	$1,600,000	ODM Approved	.....	.....	.....	.....
Carbide & Carbon Chemicals Company	Torrance, Calif.	Polyethylene Plt.	60 million lbs./ yr.	$36,000,000	Under Constr.	End, 1955	.....	.....	.....
Columbia River Chemicals	Pasco, Wash.	Anhydrous Ammonia	160 tons	$12,000,000	To Begin Late 1954	Late 1955	.....	Fluor	Fluor
		Urea	110 tons						
		Ammonium Sulfate	140 tons						

in six weeks this machine salvaged 562 tons of usable catalysts!



The successful recovery of usable catalysts from spent catalysts at the rate of 562 tons during a six-week period signals another broad step in the widespread applications of the SS&S Process — *"the bulk volume separation of dry industrial materials by effecting differences in specific gravity through air-flotation."*

Sutton's Specific Gravity Separators have been known throughout the industrial world since 1888 for their versatility and efficiency in solving separating problems. Now, the Model CS-100 serves petroleum refining with the same fabulous performance.

SUTTON, STEELE & STEELE, INC.

1031 SOUTH HASKELL • DALLAS, TEXAS

"Solving Industrial Separating Problems Since 1888"

SUTTON, STEELE & STEELE, INC.

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
General Petroleum	Torrance, Calif.	Therm. Cat. Reform.	$19,000 bbls.	$9,000,000	Complete			Soc-Vac., Bechtel	Bechtel
General Pet. Corp.	Ferndale, Wash.	Refinery	35,000 bbls.	$35,000,000	Under Constr.	Late, 1954		Bechtel	Bechtel
General Petroleum	Torrance, Calif.	Depropanizer		$350,000	Complete			E&A	E&A
Hancock Oil Co.	Long Beach, Calif.	Cat. Crker. & Facilities	6,000 bbls.	$4,068,800	Under Constr.	Mid 1955	Soc-Vac.	Parsons	Parsons
Hancock Oil Co.	Long Beach, Calif.	Cat. Poly.	500 bbls.		Under Constr.	Mid 1955	U.O.P.	Parsons	Parsons
*Hancock Oil Co.	Long Beach, Calif.	Fluid Coking Unit	6,000 bbls.	$1,814,800	ODM Certified				
*Hancock Oil Co.	Long Beach,	Cat. Reformer	2,500 bbls.	$550,000	ODM Certified				
Richfield Oil	Watson, Calif.	Expansion; Cat. Cracker Aromatics	20,000 bbls.	$43,000,000	Complete			Braun	Fluor
Rothschild Oil	Santa Fe Springs, Calif.	Cat. Crker.	6,000 bbls.	$2,000,000					Braun
*Shell Chem. Corp.	Martinez, Calif.	Ionol Plt. Exp.			Under Constr.	3rd Qtr., 1955		Staff	Staff
Shell Oil	Anacortes, Wash.	Refinery	50,000 bbls.	$75,000,000	Under Constr.	End, 1955		Bechtel	Bechtel
Shell Oil Co.	Brea, Calif.	Cap. Increase	†16 Mmcf.	$600,000	Completed				J. B. Gill Co.
Signal Oil & Gas	Los Angeles, Calif.	Butanes-Iso-butane		$500,000					
Standard (Calif.)	Richmond, Calif.	Cat. Reformer		$30,000,000	Under Constr.	July, 1955		Bechtel	Bechtel
	El Segundo, Calif.	Cat. Reformer						Bechtel	Bechtel
Standard (Calif.)	Richmond, Calif.	Isophthalic Plt.	50 mln. lbs./yr.		Engineering	Mid 1955		Staff	
Stauffer Chemical	Compton, Calif.	Sulfuric Acid		$57,070	Engineering				
Stauffer Chemical	Richmond, Calif.	Sulfuric Acid		$283,500					
*Sunset Oil Co.	Portland, Ore.	Refinery	20,000 bbls.		Considering				
The Texas Co.	Wilmington, Calif.	Platforming	10,000 bbls.		Under Constr.	2nd Qtr., 1955		Braun & Others	Braun & Others
The Texas Co.	Wilmington, Calif.	Hydrotreating	10,000 bbls.		Under Constr.	2nd Qtr., 1955		Braun & Others	Braun & Others
The Texas Co.	Wilmington, Calif.	Isomerization	1,000 bbls.		Under Constr.	2nd Qtr., 1955		Staff	Staff
Tide Water Associated Oil	Avon, Calif.	Hydrobon-Platformer	10,000 bbls.		Under Constr.	Dec., 1954	U.O.P.	Braun	Braun
Union Oil (Calif.)	Santa Maria, Calif.	Coking Plt.	18,700 bbls.	$14,075,000	Under Constr.	March, 1955		Bechtel	Bechtel
Union Oil (Calif.)	Oleum, Calif.	Unifining Unit & Auxiliary Fac.	15,750 bbls.		Under Constr.	Dec., 1954	Union Oil	Braun	Braun
Union Oil (Calif.)	Oleum, Calif.	Site Work and General Fac. for Unifiner & Platformer		$14,900,000	Under Constr.	Nov., 1954		Bechtel	Bechtel
Union Oil (Calif.)	Oleum, Calif.	Platformer and Auxiliary Fac.	14,500 bbls.		Under Constr.	Nov., 1954	U.O.P.	Braun	Braun
Union Oil (Calif.)	Oleum, Calif.	Increase Grease Mfg. Cap.		$600,000	Under Constr.	1954		Bechtel	Betchel
*Union Oil (Calif.)	Oleum, Calif.	Unisol Unit	5,000 bbls.		Under Constr.	Feb., 1955		Fluor	Fluor
*Union Oil (Calif.)	Oleum, Calif.	H_2S Recovery			Under Constr.	Feb., 1955		Fluor	Fluor
*Union Oil (Calif.)	Oleum, Calif.	Sulfur Plt.	50 tons		Under Constr.	Feb., 1955		Fluor	Fluor
Union Oil (Calif.)	Los Angeles, Calif.	Ammonia Sulfate Plt. Cap. Increase		$130,000	Under Constr.	Nov., 1954		E & A	E & A
Union Oil (Calif.)	Los Angeles	Rebuild Isomerization pH		$1,300,000	Complete			Parsons	Parsons
	Los Angeles	Fac. for Handling Enriched Crude		$950,000	Engineering			Fluor	Fluor
*Union Oil (Calif.)	Oceano, Calif.	Sulfur Recovery Plt.	42 tons		Under Constr.			Girdler	Bechtel
FOREIGN									
Canada									
British-American Oil Co.	Calgary	Cat. Reformer	2,000 bbls.		Planned	April, 1955			
British-American Oil Co.	Montreal	Cat. Reformer	9,000 bbls.		Planned	Early, 1956			
British-American Oil Co.	Moose Jaw	Capacity Inc.	16,000 bbls.		Engineering	Late 1955			
British-American Oil Co.	Moose Jaw	Thermal Crk. Unit			Engineering	Late 1955			
*British Dominion Oil Co.	Southern Alberta, Canada	Ammonium Nitrate		$1,800,000	Planning (Unconfirmed)				
Canadian Industries, Ltd.	Edmonton, Alberta	Expan. of Polyethylene Plt.	16 million lbs./yr.			End, 1954			
Canadian Petrofina, Ltd.	Montreal, Quebec, Canada	Refinery, Houdriflow Cat. Cracker, Cat. Poly Dist. Unit, Vacuum Dist., Ultraformer, Fluid Coker, Alkylation, Auxiliary, Fac., Hydrodesulfurization	20,000 bbls.	$20,000,000	Under Constr.	Late 1955	Houdry, Standard of Ind., Kellogg, Standard of N.J.		Canadian Kellogg & Lummus
Canada Southern Oils	Saskatchewan	Refinery	10-20,000 bbls.	$7,000,000-$10,000,000					
Consolidated Mining & Smelting of Canada	Calgary, Alta.	Urea Plt.			Considering				
Dow Chemical of Canada	Sarnia Ontario, Canada	Ammonia Plt. Expan.		$3,000,000	Under Constr.	1954		Fluor Associate	Fluor of Canada
Hooker Chemicals, Ltd.	N. Vancouver, B. C.	Chemicals			Projected				
Imperial Chemical Industries of Canada	Milhaven, Ont.	"Terylene" Plt.	11,000,000 lbs./yr.	$20,000,000	Pilot Plt. in Operation	Mid 1955		Ferguson	Ferguson
Imperial Oil	Sarnia, Ontario	Quality Control Lab. Packaging & Shipping Plt. and Mech. Shops		$6,000,000	Under Constr.	1954			Canadian Bechtel
Imperial Oil, Ltd.	Edmonton, Alberta	Lube Oil Plt.	2,000 bbls.	$14,000,000	Under Constr.	Late, 1955		Staff	Can. Kellogg
Imperial Oil, Ltd.	Montreal, Quebec	25% Cap. Increase	†12,000 bbls.	$10,000,000	Under Constr.	Early, 1955		Staff, Can. Bechtel	Canadian Bechtel

EAGLE-PICHER

Blanket Insulation

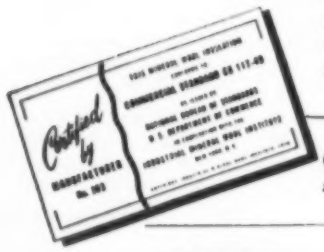
FACTORY FABRICATED ...to rigid specifications

FACTORY FABRICATION means that every blanket is made up of many felted layers of Eagle-Picher Mineral Wool—with ends overlapped to form smooth, firm edges that can be tightly, efficiently butted together.

FACTORY FABRICATION prevents large "voids" so often found in field-fabricated blankets where insulation is simply packed in place. Rigidly controlled production methods assure efficient mineral fibers are evenly dispersed over the entire insulating area.

FACTORY FABRICATION offers extra-sturdy, flexible construction . . . a blanket that lends itself to scores of uses. Copper bearing steel laths—bound by *uniformly spaced* soft-drawn galvanized tie wires—keep the blankets firm but flexible.

PROFIT from the advantages factory-fabricated insulating blankets can give you in your operations. Get Eagle-Picher Blankets for all of your important jobs.



CERTIFIED *to conform to Commercial Standards CS-117, as shown by the Certification seal on each blanket. Also conforms to Federal Specification HH-1-563.*

Since 1843

EAGLE EP PICHER

THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

For greater efficiency, protection and economy, you should specify these Eagle-Picher products:

Insulating Felts • Insulating Block • Blankets • Loose Wool • Mineral Wool Pipe Covering • Stalastic Stamastic • Insulseal • Finishing Cements • Insulating Cements • Swetchek • Insul-Stic • Fireproofing Cement

Member of Industrial Mineral Fiber Institute

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Imperial Oil, Ltd.	Imperoyal, Canada (near Halifax)	Rebuild Existing Plt. including Fluid Cat. Cracker	41,625 bbls.	$25-30,000,000	Constr. to start Early 1955	Summer, 1956	.....	.....	.....
Kendall Refg. of Canada	Toronto, Canada	Lub. Oil Compounding, packaging & Distrib. Plt.	27,000 bbls.	.....	Considering	Summer, 1956 Indefinite	.....	.....	.....
McColl Frontenac Oil Co.	Edmonton, Alberta	Capacity Increase	11,000 bbls.	$4,000,000	Under Constr.	July, 1955	.....	Staff	.....
McColl-Frontenac Oil Co.	Edmonton, Alberta	Thermal Cracking Unit	3,000 bbls.	.....	Engineering	July, 1955	.....	Can. Kellogg	Can. Kellogg
McColl-Frontenac	Montreal, East	Platformer	12,000 bbls.	.....	Engineering	May, 1955	U.O.P.	Procon Can.	Procon Can.
Midland Pet. & Pacific Pet.	Stettler, Alta.	Crude Refinery	4,000 bbls.	$2,000,000	Under Constr.	.....	.....	.....	.....
North Star Oil, Ltd.	St. Boniface, Manitoba	Modernization, Cat. Crker.	8,000 bbls.	$5-6,000,000	Engineering	1955	U.O.P.	U.O.P., Kellogg	Can. Kellogg
North Star Oil, Ltd.	St. Boniface, Manitoba	Refinery	12,000 bbls.	$10,000,000	Under Constr.	July, 1955	U.O.P.	Can. Kellogg	Can. Kellogg
Royalite Oil Co.	Kamloops, B.C.	FluidCat.Crker., Poly & Gas Concentration	1,425 bbls.	$2,500,000	Under Constr.	Mar., 1955	U.O.P.	Caribou Eng. Co.	Caribou Eng. Co.
Shell Oil Co. of Canada	Okotoks, Canada	Sulfur Ext. Plt.	.....	.....	Planned	.....	.....	.....	.....
Shell Oil Co. of Canada, Ltd.	Jumping Pound, Alberta, Canada	Gas Plt. Expan.	†30 Mmcf.	$1,500,000	Under Constr.	1954	.....	.....	Treco
Shell Oil of Canada	Calgary, Alberta, Canada	Sulfur Plt. Cap. Increase	†55 tons	.....	Under Constr.	Dec., 1954	.....	Parsons	Parsons
Sherritt-Gordon Mines, Ltd.	Fort Saskatchewan, Alta.	Anhydrous Ammonia	75 tons	.....	Planned	.....	.....	.....	.....
Standard Oil Company of British Columbia, Ltd.	Burnaby, B.C.	Refinery Cat. Cracker	11,000 bbls. 2,750 bbls.	$10,000,000	Under Constr.	4th Qtr., 1954	.....	.....	Fluor
Texaco Oil Co.	Edmonton, Canada	Gas Absorp. Plt.	.....	$6,000,000	Under Constr.	.....	.....	.....	.....
Trinidad Leaseholds	Port Credit, Ontario	Platformer	2,300 bbls.	$1,000,000	Complete	.....	U.O.P.	Procon (Can.)	Procon (Can.)
Wainwright Producers & Refiners, Ltd.	Edmonton, Alberta, Canada	Cap. Inc.	†2,300 bbls.	.....	Planned	.....	.....	Treco	Treco
Latin America									
Caribbean Refining Co.	San Juan, Puerto Rico	Refinery	10,000 bbls.	$11,000,000	Under Constr.	1st Qtr., 1955	U.O.P.	Fluor	Fluor
Colombian Petro-Company	Barco Concession	Gas Treating Plt.	2,000 bbls.	$5,000,000	Under Constr.	.....	.....	.....	.....
Companhia de Petroleo da Amazonia	Manaus, Brazil	Refinery; Cat. Crker & Aux. Units	5,000 bbls.	$4,000,000	Engineering	Late 1955	U.O.P.	Sweco	Sweco
*Compania Shell de Venezuela	Cardon, Venezuela	Cat. Crker.	35,000 bbls.	Part of $56,000,000 Project	Planned	End, 1957	.....	.....	.....
Conselho Nacional do Petroleo	Cubatao, Sao Paulo, Brazil	Therm. Crk. Ref. Reforming, Vis Breaking Cat. Poly.	45,000 bbls.	$60,000,000	Under Constr.	End 1954	Hydrocarbon Calif. Res., Shell Dev., Edeleanu	PA Hydro Res.	Pa Hydro Res. and McKee
Conselho Nacional do Petroleo	Cubatao, Brazil	Anhydrous Ammonia	100 tons	.....	Under Constr.	Late 1955	Texaco Dev.	Foster Wheeler	Foster Wheeler
Conselho Nacional do Petroleo	Bahia, Brazil	Lube Oil Fac.	2,000 bbls.	$12,000,000	Planned	.....	.....	.....	.....
Conselho Nacional do Petroleo	Cubatao, Sao Paulo, Brazil	Expansion Expansion	10,000 bbls. 30,000 bbls.	.....	Studies	.....	.....	.....	.....
Creole Pet. Corp.	Amuay Bay, Estado Falcon, Venezuela	Atmospheric Pipestill	70,000 bbls.	$44,000,000	Completing	.....	.....	Foster Wheeler	Foster Wheeler
Creole Petroleum Corp.	Amuay	Fluid Hydroformer	10,000 bbls.	.....	Engineering	Feb., 1955	S.O.D.	S.O.D.	Foster Wheeler
*Creole Pet. Corp.	Amuay Bay	Vac. Pipestill	42,000 bbls.	$7,000,000	Under Constr.	April, 1955	.....	Foster Wheeler	Foster Wheeler
*N. V. Curacaosche Petroleum Industrie Maatschappij	Curacao, N.A.	Cat. Crker.	.....	Part of $56,000,000 Project	Planned	End, 1957	.....	.....	.....
Helios, S.A.	San Andres, Peru	Lube Oil; Asphalt Refinery	60,000 tons lube oil; 10,000 tons Asphalt/yr.	$8,000,000	Projected	Early 1956	.....	Hydrocarbon	.....
International Petroleum (Colombia), Ltd.	Cartagena, Colombia	Refinery	25,000 bbls.	$35,000,000	Planned	Late 1957	.....	.....	.....
International Petroleum Co., Ltd.	Talara, Peru	Pipe Still	45,000 bbls.	.....	Complete	.....	.....	.....	.....
Petroleos Mexicanos	Tamaulipas, Ciudad Madero, Mexico	Enlarge Refinery Capacity	47,250 bbls.	$22,000,000	Projected	.....	.....	.....	.....
Petroleos Mexicanos	Tamaulipas, Arbol Grande Pet. Mex.	Enlarge Refinery	16,600 bbls.	.....	Projected	1954	.....	.....	Staff
Petroleos Mexicanos	Mata Redonda, Vera Cruz, Mex.	Improvements	.....	.....	Projected	1954	.....	.....	Staf.
Petroleos Mexicanos	Poza Rica, Mex.	Expansion	†100 Mmcf.	$8,600,000	Under Constr.	1954	.....	McKee	McKee
Petroleos Mexicanos	Reynosa, Mex.	Expansion	5,000 bbls.	.....	Project	1954	.....	.....	Staff
Petroleos Mexicanos	Poza Rica, Vev.	Expan. Gas Absorption Purifiesting; Sulfur Mfg.	120 Mmcf.	$20,000,000	Under Constr.	1954	.....	McKee	Staff
Petroleos Mexicanos	Mexico, D.F.	Cap. Increase	30,000 bbls.	$7,000,000	Projected	1954	.....	.....	.....
Petroleos Mexicanos	Tampico, Tamps	Crude Oil Refinery Mod., Vac. Dist., Cat. Crker & Related Fac.	75,000 bbls.	$33,000,000	Projected	1954	.....	.....	.....
Petroleos Mexicanos	Minatitlan, Vev.	Expansion: Topping Unit, Feed Preparation Fractionation, Gas Concentration, Poly, Unit, Offsite Fac., Cat. Crker.	8,000 bbls.	$3,700,000	Contract let	1954	.....	.....	Fluor
Puerto Rican Oil Refining Co.	Near Ponce, Puerto Rico	Refinery	25,000 bbls.	$20,000,000	Projected	.....	Undetermined	Brinckerhoff, Hall and Macdonald	.....
Refinaria de Petroleos de Manguinhos S/A	Rio de Janeiro, Brazil	Thermal Crk., Vis-Breaking	10,000 bbls.	$12,000,000	Under Constr.	End, 1954	Edeleanu	Kellogg PA	Kellogg PA

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
Refinaria e Exploracao de Petroleo Uniao" S.A.	Caguava, Sao Paulo, Brazil	TCC Recovery Cat. Poly.	20,000 bbls.	.....	Under Constr.	1954	Hydrocarbon Calif. Res., Soc.-Vac.	Hydrocarbon	Hydrocarbon
Yacimientos Petroliferos Fiscales	Eva Peron, Argentina	Refinery	28,300 bbls.	.....	.....	.....	.....	Kellogg	Kellogg
Yacimientos Petroliferos Fiscales (ENDE)	Eva Peron, Argentina	Integrated Dist.	31,000 bbls.	.....	Under Constr.	1954	Kellogg	Kellogg, Y.P.F.	Y.P.F.
Yacimientos Petroliferos Fiscales (ENDE)	Luian de Cuyo Mendoza, Argentina	Dist. Expan.	8,300 bbls.	.....	Under Constr.	1954	.....	Y.P.F.	Y.P.F.
Yacimientos Petroliferos Fiscales (ENDE)	Cerro Bandera P. Huincul Neuquen, Argentina	Dehydration Plt.	10,400 bbls.	.....	Under Constr.	1955	.....	Y.P.F.	Y.P.F.
Europe and Africa									
Anglo-Iranian Oil	Kent, England	Acid/Soda Treat.	2,100 bbls.	.....	Under Constr.	.....	.....	.....	.....
Anglo-Iranian Oil	Kent, England	Platformer	6,000 bbls.	.....	Under Constr.	End, 1954	U.O.P.	Procon (G.B.)	E. B. Badger, Ltd.
Anglo-Iranian Oil	Kent, England	Vacuum Unit	17,000 bbls.	.....	Under Constr.	.....	.....	E.B.Badger, Ltd.	E.B.Badger, Ltd
Anglo-Transvaal Consolidated Investment Co.	Vail River, Union of South Africa	Synthetic Gasoline and Diesel Oil Plt.	.....	$50-60,000,000	Contracted	.....	.....	.....	.....
Badische Anilin & Soda Fabrik, A.G. & Deutsche Shell	Wesseling Area, W. Germany	Polyethylene & Ethylbenzene pH	.....	.....	Projected	1955	.....	.....	.....
N. V. de Bataafsche Pet. Maatschappij	Pernis, Netherlands	Aldrin & Dieldrin Plt.	3,000 tons	.....	Complete	.....	.....	.....	.....
N. V. de Bataafsche Pat. Maatschappij	Pernis, Netherlands	Desalting Unit	12,000 bbls.	.....	Under Constr.	Fall, 1954	.....	S & W Badger Div., E. B. Badger, Ltd.	.....
N. V. de Bataafsche Petroleum Maatschappij	Pernis, Holland	Luboil Ref. Exp.	1,750 bbls.	.....	Under Constr.	Early, 1955	.....	.....	.....
*N. V. Bataafsche Petroleum Maatschappij	Pernis, Netherlands	Cat. Crker.	35,000 bbls.	.....	Under Constr.	Nov., 1956	.....	.....	.....
B. P. Benzin	Hamburg, Germ.	Platformer	5,000 bbls.	.....	Complete	.....	U.O.P.	.....	Procon
*Berry Wiggins & Co., Ltd.	Weaste Ref., Manchester, England. Ship Canal	Extension to Refinery	500 bbls.	.....	Under Constr.	.....	.....	H.W.P.	H.W.P.
Condor, S.P.A. Per Industriale Pet. Chemica	Rho, Italy	Capacity Increase	27,000 bbls.	.....	Complete	.....	.....	.....	.....
Egyptian Government	Cairo, Egypt	Refinery	20,000 bbls.	.....	Planning	.....	.....	Lummus	Lummus
Egyptian Government	Suez, Egypt	Inc. Refn. Cap.	26,000 bbls.	$24,000,000	Planning	.....	.....	.....	Lummus
Empresa Nacional "Calvo Sotelo"	Puertollano, Spain	Shale Oil Refg.	3,000 bbls.	$46,000,000	Under Constr.	1954	Basf, Lurgi.	Basf, Lurgi	Basf, Lurgi
Gelsenberg-Benzin A. G.	Gelsenkirchen, Horst, Germany	Platformer	7,100 bbls.	$7,500,000	Under Constr.	Nov., 1954	U.O.P.	Procon (G.B.)	Procon (G.B.)
Greek Government	Greece	Refinery	25,000 bbls.	$20,000,000	Planned	.....	.....	.....	.....
I.L.S.E.A.	Valmadrera, Como, Italy	Cat. Reforming Unit	500 bbls.	.....	Under Constr.	End, 1954	Atlantic	Tecnider	Tecnider
Imperial Chemical Industries	Wilton, England	Terylene Plt.	11 mln. lbs./yr.	$56,000,000	Under Constr.	Early 1955	.....	Kellogg	Kellogg
*Imperial Chemical Industries	Wilton, England	Butadiene Separation Plt.	.....	.....	Design	.....	.....	H.W.P.	.....
Industria Petrolifera e Chimica	Milan, Italy	Gasoline Fuel Oil Plt.	20,000 bbls.	.....	.....	.....	.....	Dr. Calogero Inglogio	.....
Industria Raffinazione Oli Minerali	Venice, Italy	Cat. Crker.	10,000 bbls.	.....	Planned	.....	.....	.....	.....
Kali Chemie Co.	Nienberg, Germany	Read Catalyst Plt.	.....	.....	Licensed	.....	Soc.-Vac.	.....	.....
Monsanto Chemicals Ltd.	Britain	Add Polystyrene	.....	.....	Under Constr.	.....	.....	Staff	Staff
Monsanto Chemicals Ltd.,	Britain	Styrene-Butadiene Copolymer Plt	4,000 tons/yr.	$14,000,000	Planned	.....	.....	.....	.....
A. P. Moeller	Copenhagen, Denmark	Thermal Crker. Plt.	3,000 bbls.	$3,500,000	Complete	.....	.....	.....	.....
P. Moeller	Copenhagen, Denmark	Refinery	.....	$11,500,000	Planning (Unconfirmed)	.....	.....	.....	.....
National Oil Refineries, Ltd.	Llandarcy	Platformer	6,000 bbls.	$3,500,000	Under Constr.	Early, 1955	U.O.P.	Procon (G.B.)	E.B.Badger, Ltd.
Refineria de Petroleos de Escombreras S. A. (REPESA)	Escombreras, Spain	Furfural Ref.	.....	.....	Under Constr.	1955	Texaco Dev.	Foster Wheeler	Foster Wheeler
Shell Refining & Marketing Co	Stanlow, England	Hydro Desulfurization	4,800 bbls.	.....	Under Constr.	Early 1955	.....	.....	.....
*Shell Refining & Marketing	Stanlow, England	Isopentane Plt	.....	$1,400,000	Under Constr.	Early, 1955	.....	H.W.P.	.....
*Shell	Shell Haven, England	Platformer	5,800 bbls.	.....	Under Constr.	Late, 1955	.....	.....	.....
*Shell	Stanlow, England	Extension to Distilling Plt.	I.P.A. 67 tons, S.B.A. 102 tons	.....	Design	.....	.....	H.W.P.	.....
Sociedade Anonima Concessionaria da Refinacao de Petroleos em Portugal, SACOR	Cabo Ruivo, Lisbon, Portugal	Topping, TCC Poly., SO2 Extraction, Asphalt	30,000 bbls.	.....	Complete	.....	Soc-Vac.	Hydrocarbon Koch	Hydrocarbon, Koch
Soc. An. Raffinazione Oli Minerali-SAROM	Ravenna, Italy	Topping Unit	15,000 bbls.	.....	Under Constr.	End, 1954	.....	Tecnider	Staff
		Visbreaker	5,000 bbls.	.....	Under Constr.	March, 1955	.....	Tecnider	Tecnider, Ansaldo
*Societe des Reffineries de Petrole de la Gironde	Bec d'Ambes, Gironde, France	Cat. Crker.	4,000 bbls.	.....	Planning	1956	.....	.....	.....
		Vacuum Unit	6,300 bbls.	.....	Planning	1956	.....	.....	.....
		Poly Plt.	540 bbls. (Product)	.....	Planning	1956	.....	.....	.....
Societa Per Azioni Raffineria Padana Oli Minerali (SARPOM)	San Martino di Trecate (Novara), Italy Trecate (Novara), Italy	Cat. Crker.	2,880 bbls.	.....	Under Constr.	1955	.....	U.O.P., E. B. Badger, Ltd.	S & W Badger Div.
		Vacuum Unit	5,150 bbls.	.....	Under Constr.	1955	.....	S & W Badger	S & W Badger Div.
		Poly Plt.	315 bbls.	.....	Under Constr.	1955	.....	Foster Wheeler	S & W Badger Div.
Societe Generale Huile Petroles	Lavera, France	Platformer	6,000 bbls.	.....	Under Constr.	End, 1954	U.O.P.	Procon & E.B. Badger, Ltd.	E.B.Badger, Ltd.
Societe Industrielle Belge des Petroles	Antwerp, Belgium	Cat. Crker.	10,000 bbls.	$10,000,000	Under Constr.	1st Qtr., 1955	U.O.P.	Lummus	Lummus

● Table concluded on page 198.

HUSKY'S RESULTS

The Charge		The Product	
API	58.8	API	62.8
Sulfur %	0.1	Sulfur %	0.001
RVP	5.1	RVP	12.0
ASTM Over	95	ASTM Over	97
End Pt.	370	End Pt.	398
CFRR Octane Clear	54.0	CFRR Octane Clear	90.6
		Sec	94.6
		C4 Plus Yield, Vol. %	98.8

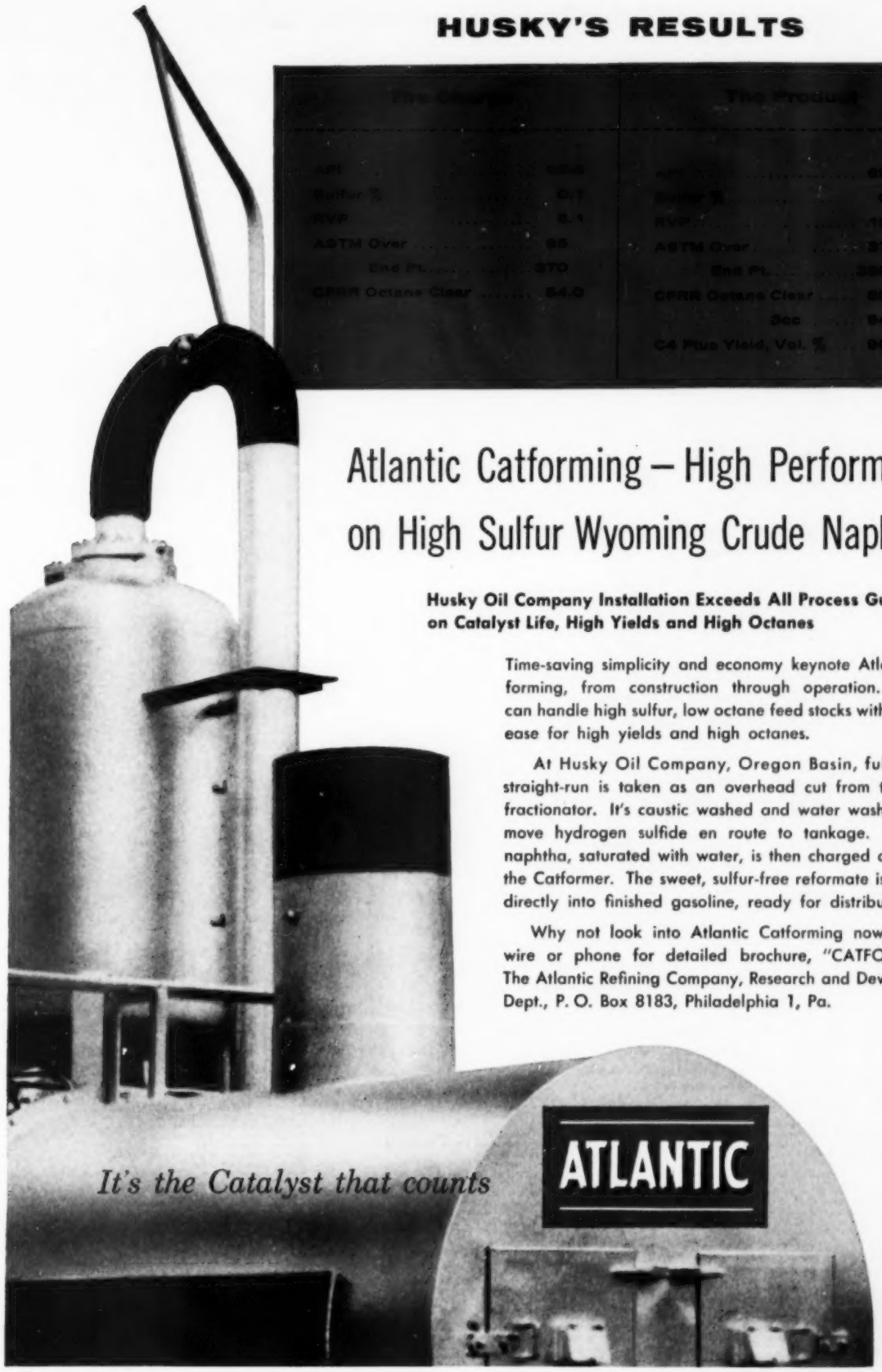
Atlantic Catforming – High Performance on High Sulfur Wyoming Crude Naphthas

Husky Oil Company Installation Exceeds All Process Guarantees on Catalyst Life, High Yields and High Octanes

Time-saving simplicity and economy keynote Atlantic Catforming, from construction through operation. Refiners can handle high sulfur, low octane feed stocks with one-step ease for high yields and high octanes.

At Husky Oil Company, Oregon Basin, full-boiling straight-run is taken as an overhead cut from the crude fractionator. It's caustic washed and water washed to remove hydrogen sulfide en route to tankage. This raw naphtha, saturated with water, is then charged directly to the Catformer. The sweet, sulfur-free reformate is blended directly into finished gasoline, ready for distribution.

Why not look into Atlantic Catforming now? Write, wire or phone for detailed brochure, "CATFORMING." The Atlantic Refining Company, Research and Development Dept., P. O. Box 8183, Philadelphia 1, Pa.



It's the Catalyst that counts

For more data on advertised products, use Readers' Service Cards, last page.

REFINERY AND OTHER PLANT CONSTRUCTION—*Continued*

COMPANY	Plant Site	Project	Daily Capacity	Estimated Cost	Status	Probable Completion	Licensor	Engineering	Contractor
S.I.B.P.	Antwerp, Belgium	Cat. Poly. Unit	3,000 bbls.		Under Constr.	1st Qtr., 1955	U.O.P.	Lummus	Lummus
Socony-Vacuum Italiana, S.P.A.	Naples, Italy	Cat. Poly.		$724,000	Under Constr.	2nd Qtr., 1955	Calif. Res.	Mediterranean Builders, Inc.	C.T.I.P.
Socony-Vacuum Italiana, S.P.A.	Naples, Italy	TCC			Under Constr.	2nd Qtr., 1955	Soc.-Vac.	Mediterranean Builders, Inc.	C.T.I.P.
South Africa Coal Oil & Gas	Coalbrook, Orange Free St.	Plt. Ref. Expan.	3,500 bbls.	$50,400,000	Under Constr.	1955		Kellogg	Kellogg
S.P.A. Tecnico Industriale Aquila	Trieste	Cat. Cracking	3,300 bbls.		Under Constr.		Soc.-Vac.	Staff	Staff
S.P.A. Tecnico Industriale Aquila	Trieste	Cat. Poly.	1,400 bbls.		Under Constr.		U.O.P.	Staff	Staff
Turkish Government	Kutahya, Turkey	Nitrogen Plt.			Projected				
Turkiye Petrolleri A.O.	Batman, Turkey	Refinery	6,950 bbls.	$10,000,000	Under Constr.	End 1954		Parsons	Parsons
Union Petrol Refinery, Ltd.	Johannesburg, Union of South Africa	New Refinery		$20,000,000	Projected				
Universal-Matthey & Co.	England	Ref. Catalyst			Under Constr.	1954			Procon
Near East									
Anglo-Iranian	Aden	New Refinery	100,000 bbls.		Complete			G. Wimpey (London) Middle East Bechtel Staff	Middle East Bechtel Staff
Arabian American Oil Company	Ras Tanura, Saudi Arabia	Fluid Cat. Hydroformer	12,500 bbls.	$9,825,000	Under Constr.	Jan., 1956	S.O.D.	Lummus, Aramco	Lummus
Bahrain Petroleum Co.	Bahrain	Vacuum Still	25,000 bbls		Planning	1955		Lummus	
Fertilizers & Chemicals	Haifa, Israel	Hydrogen, Ammonia, Sulfuric Acid, Nitric Acid, Ammonia Sulfur, Ammonia Nitrate		$15,000,000	Under Constr.	Late 1954		Chemico	Staff
*Iraq Government	Dora, Iraq	Lube Oil Plt.	25,000 tons/yr.		Planned (Unconfirmed)				
Jordanian Reconstruction Council	Mafrak, Jordan	Refinery		$7,500,000	Planned				
Kadimah Chemical Corp.	Haifa, Israel	Detergent Mfg.	10 tons	$500,000	Under Constr.	Late 1954			Staff
Mediterranean Refining Co.	Sidon, Lebanon	Refinery	9,000 bbls		Under Constr.		U.O.P.	Bechtel Asso.	Bechtel Asso.
Saudi Arabian Government	Saudi Arabia	Ammonium Sulfate Plt.	400,000 Metric tons/yr. Plus 500 tons Dry Ice		Proposed			Procon	
Far East									
Burma Oil Co.	Chauk, Burma	Distil. Unit	2,500 bbls.		Under Constr.				
Burmah Shell	Bombay, India	Refinery	40,000 bbls.	$47,000,000	Under Constr.	Early, 1955			
Ceylon Government	Ceylon	Refinery			Negotiating				
Chinese Petroleum Corp.	Kaohsiung, Taiwan (Formosa)	Thermofor. Cat. Crker.	10,000 bbls.		Under Constr.	2nd Qtr., 1955	Soc.-Vac.		Fluor
Daikyo Oil Co., Ltd.	Yokkaichi, Japan	Houdriflow & Cat. Poly.	3,500 bbls.		Under Constr.	Early, 1955	Houdry & Calif. Res.	Houdry	
Mitsubishi Oil Co,Ltd.	Tokyo, Japan	Vac. Distl. Unit	2,000 bbls.						
Nippon Petroleum Refining Co., Ltd.	Yokohama, Japan	Modern. and Expansion	12,000 bbls.		Under Constr.	1955		McKee	McKee
Showa Oil Company	Tokuyama, Japan	Refining Fac.			Planning				
Showa Oil Company	Tokuyama, Japan	Petrochemicals			Planning				
Showa Oil Company	Hirasawa, Japan	Alkyl Sulfonate	2 tons (Pilot Plt.)		Testing				
Standard Vacuum Refinery	Sumatra	Refinery Mod.						Foster Wheeler	Foster Wheeler
Oceania									
A.I.O.C.	Kwinana, Australia	Refinery	60,000 bbls.		Under Constr.	Early, 1955			Kellogg, Kellogg International, Costain-John Brown
Australian Oil Refining, Ltd.	Kurnell, Australia	Refinery	22,000 bbls.		Under Constr.	1955		S. & W. Badger Div., E. B. Badger, Ltd., Ewbank & Partners, Christiani and Nielson, Foster Wheeler	E. B. Badger Pty.
Australian Shell	Geelong, Australia	Cat. Cracking Unit	12,500 bbls.		Projected	Mid 1955			
Caltex (Philippines, Inc.)	Batangas, P.I.	Refinery	13,000 bbls.		Under Constr.	1954		Foster Wheeler, McKee, Bechtel	Foster Wheeler
Petroleum and Chemical Corp.	Silverwater, Australia	Petrochemical Plt.		$7,000,000	Planned	Dec., 1955			Gas Corp., Ltd.
Standard-Vacuum Refining Co., Ltd.	Melbourne, Aust.	Refinery Expan.	25,000 bbls.	$30,000,000	Under Constr.	Jan., 1955		Braun, Soc.-Vac.	Braun

* First appearance in tabulation † Added capacity

NOTE:
Atlantic—Atlantic Ref. Co.
Austin—Austin Co.
Badger Mfg.—Badger Manufacturing Co.
E. B. Badger Ltd.—E. B. Badger & Sons Ltd.
E. B. Badger Pty.—E. B. Badger & Sons Pty., Ltd.
Barnes—W. M. Barnes Co.
Bechtel—Bechtel Corp.
Blaw-Knox—Blaw-Knox Co.
Braun—C. F. Braun Co.
Brown & Root—Brown & Root Construction Co.
Buckner—F. J. Buckner Corp.
Calif. Res.—California Research Corp.
Can. Kellogg—Canadian Kellogg Co.
Cat. Constr.—Catalytic Construction Co.
Chemico—Chemical Construction Co.
Ch. Pro.—Chemical Process, Inc.
C. B. & I.—Chicago Bridge & Iron Co.
Chiyoda—Chiyoda Chemical Engineering & Construction Co., Ltd.
C. & I.—Chemical & Industrial Corp.
Consd. Eng.—Consolidated Engineering Company
Craig—A. F. Craig & Co.
D & Z—Day & Zimmerman
Delta—Delta Engineering Corp.
Dresser—Dresser Engineering Corp.
Ebasco—Ebasco Services, Inc.
E&A—Ehrhart & Arthur, Inc.
Edeleanu—Edeleanu Gesellschaft M.B. H.
Etabadger, S.A.—Etablissement Badger, S.A.
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Ferguson—H. K. Ferguson Co.
Fluor—Fluor Corp.
Foster Wheeler—Foster Wheeler Corp.
Gas Plant Constr.—Gasoline Plant Const. Corp.
Girdler—The Girdler Co.
Graff—Graff Engineering & Equipment
Graver—Graver Construction Co.
Grebe & Doremus—Grebe & Doremus Process Co.
Gutte-Hutte—Gutte Hofnungs Hutte
Hercules—Hercules Powder Co.
Hudson—Hudson Engineering Corp.
H.W.P.—Head Wrightson Process, Ltd.
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Hydro M—Hydrocarbon Mineraloel G.m.b.H.
Hydro E—Hydrocarbon Engineering S.A.R.L.
Kaiser—Kaiser Engineers
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Kellogg P A—Kellogg Pan American
Koch—Koch Engineering Company
Koppers—Koppers Co., Inc.
Lummus—The Lummus Co.
Masco—Masco Corp.
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S & W Badger Div.—Stone & Webster Engineering Corp., Badger Process Div.
S & W Canada Ltd.—Stone & Webster Canada Ltd.
Sweco—Southwestern Engineering Co.
Tears—Tears Engineers
Tellepsen—Tellepsen Construction Co.
Texaco Dev.—Texaco Development Corp.
Texaco—The Texas Co.
Texas Natural—Texas Natural Gasoline Corp.
Treco—Refinery Engineering Co.
U.O.P.—Universal Oil Products Co.
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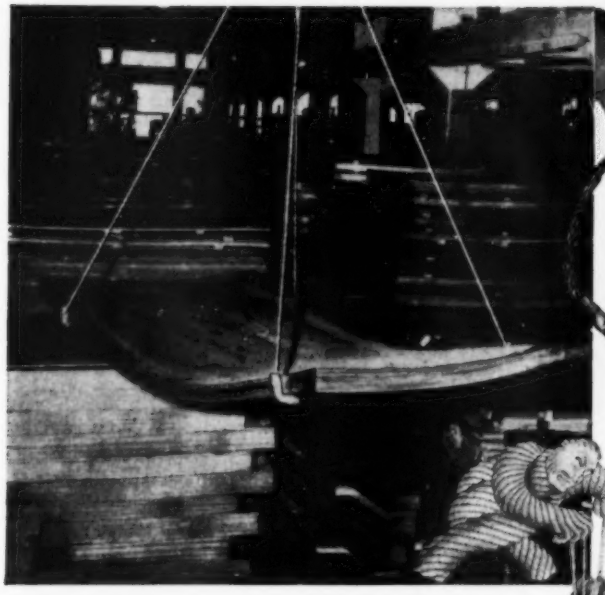

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Who's Meeting . . .

ACS at New York . . .

. . . **More** work is being done on the chemistry of catalytic reforming reactions. New research shows that the effect of various potential catalytic poisons is as follows: (1) Water increases hydrocracking and decreases dehydrocyclization activity. Dehydrogenation activity is unaffected. (2) Ammonia decreases both the hydrocracking activity and the dehydrocyclization activity. Again dehydrogenation is unaffected. (3) Sulfur as H_2S increases hydrocracking and decreases dehydrocyclization and dehydrogenation activity. (4) The effect of water, sulfur and nitrogen on catalyst activity is temporary and activity is readily restored by regeneration (W. P. Hettinger, C. D. Keith, J. L. Gring and J. W. Teter, Sinclair Research Laboratory, Harvey, Ill.).

. . . **Studies** of dehydrocyclization in platforming indicate that the conversion of paraffins to aromatics by dehydrocyclization takes place to a greater extent with the naphthene lean stock, since the platformates derived from widely differing charge stocks do not show large variation in aromatic content. At higher octane numbers aromatic production is about the same for all stocks since at that point the reactants consist essentially of paraffins and aromatics. More of the paraffins undergo hydrocracking as the paraffin content of the charge is increased. As the paraffins readily isomerize to the equilibrium concentrations, the net result is an increase in the contribution of paraffin to the octane number of platformates (G. R. Donaldson, L. S. Pasikn, Vlabimir Haensel, Universal Oil Products Company, Riverside, Ill.).

. . . **Research** on Houdriforming indicates that hydrocracked naphtha consists of (1) paraffin, mostly of straight chained character and low octane number and derived from paraffins and naphthenes (2) naphthenes consisting of saturated rings with short side chains derived primarily from hydrogenation of aromatics, and (3) aromatics obtained from high molecular weight aromatics by partial hydrogenation cracking. The composition of such a hydrocracked naphtha is believed to lend itself well to upgrading by hydrogenative reforming (Heinz Heinemann, J. B. Hattmann and J. W. Schall, Houdry Process Corporation, Linwood, Pa.).

. . . **The operation** of the first commercial Houdriforming unit for production of aromatics has confirmed pilot unit studies in most respects. Xylene yields in excess of 100 percent of the theoretical amounts that can be produced from the naphthene in the charge are being obtained. The only significant difference existing between pilot unit operation and commercial plant operation is that the catalyst life is considerably longer in the commercial plant than was predicted from pilot plant data. This is most likely a result of trace contaminates introduced to the pilot plant charge stock during the preparation and handling (D. Beyler, F. R. Shuman, D. H. Stevenson, Houdry Process Corporation and Sun Oil Company).

. . . **Latest** Shell research indicates a process which would selectively desulfurize cracked gasoline and partially saturate diolefins without loss in unleaded octane number of the treated product. The catalyst is tungsten nickel sulfide. Reasonably long processing periods with the hydrotreating catalyst have been obtained (R. N. Casagrande, W. K. Meerbott, A. S. Sartor, and R. P. Trainer, Shell Oil Company, Houston).

. . . **A simple** method has been developed for treating of cracked gasoline for storage stability improvement. The catalyst used is boron trifluoride. The treating process consists simply of continuously contacting boron trifluoride with the unstable gasoline in a relatively simple reactor followed by settlings to remove the small amount of insoluble sludge which is produced, water washing to remove residual boron trifluoride and redistilling to remove soluble polymers. The operation preferably is carried out at room temperature, atmospheric pressure, and contact time of 1 to 10 minutes (H. Beuther and R. G. Goldthwait, Gulf Research and Development Company, Pittsburgh). New data makes it conclusive that metal oxides lower catalyst activity. A given metal oxide concentration causes a larger

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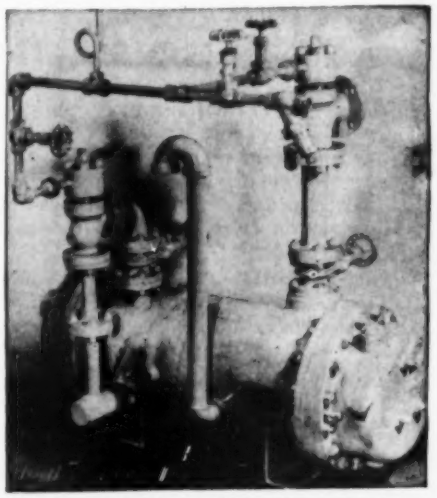

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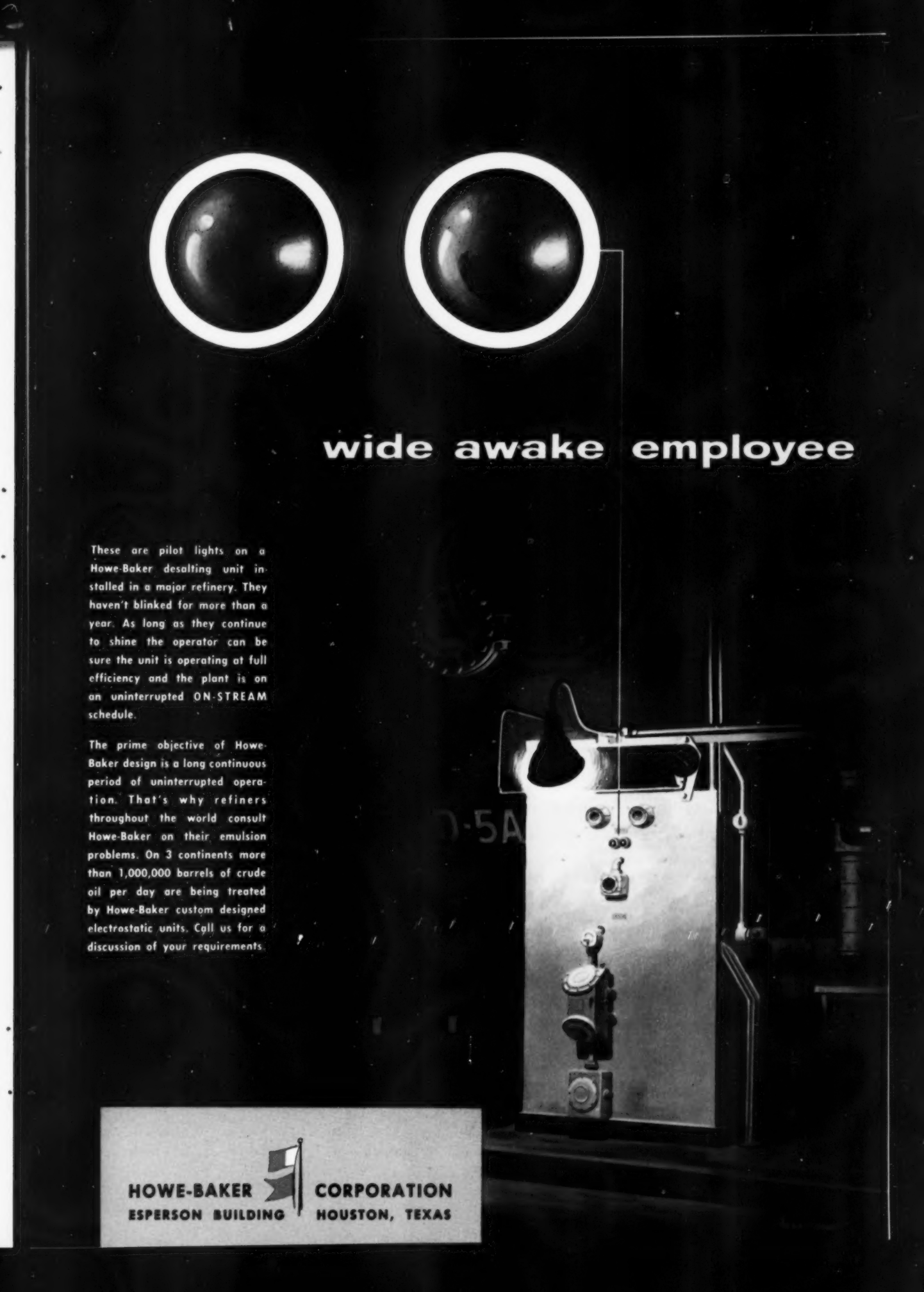
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activity reduction for a high activity catalyst than for a low activity catalyst. From the metal oxide study chromium oxide is the most harmful to the catalyst selectivity followed by nickel, vanadium, iron, and copper. Tin, lead, titanium, sodium, manganese, and potassium had very little effect on selectivity. Combinations of metal oxides are more harmful to selectivity than expected from the added effect of each component (C. H. McIntosh, The Texas Company, Port Arthur, Texas).

... **Refiners** with spare thermal capacity can well afford to investigate the thermal processing of catalytic naphtha. Latest studies show the thermal cracking of catalytic naphtha produces a higher yield of a higher octane gasoline than can be obtained from a comparable straight run naphtha (Andrea W. Pollock, Sun Oil Company, Marcus Hook, Pa.).

... **So far** the Udex extraction process has been utilized for recovery of benzene, toluene, and xylenes only from saturated concentrates. Recent studies indicate that the recovery of pure aromatics from any particular *cracked stock* must depend upon the types of unsaturated compounds present, their amount, and the ability of conventional finishing operations to remove residual amounts of these materials left in the extract. The direct Udex extraction of highly unsaturated cracked naphthas, followed by a clay treat of the extract, yields aromatics of nitration grade quality only if the conjugated diene content of the feed is low (Herman S. Bloch and Richard C. Wackher, Universal Oil Products Company, Riverside).

... **Latest** report from Humble's paraxlyene plant shows very satisfactory production of 25 million pounds of paraxylene during the last year. This plant employs a two-stage low temperature crystallization and centrifugation process for the recovery of paraxylene from solvent xylenes feed. Plant preformance has demonstrated that the two-stage process is flexible and that it permits close control of product quality at a high purity level and at the same time allows the realization of theoretical paraxylene yield (J. M. Powers and R. B. Bennett, Humble Oil & Refining Company, Baytown, Texas).

LPG Symposium at St. Louis . . .

... **The Symposium** on Methods for Testing Liquefied Petroleum Gases held September 27 and 28 showed how much the spectroscopic methods are beginning to replace standard methods involving the conventional fractional distillation and Orsat procedures. Both mass and infrared spectrometers can provide highly accurate analyses in a fraction of the time required for the older methods. Modern methods of these types have become so stable and reliable in operation that there is no question that present day laboratory personnel are fully capable of operating them. The next logical step would be to install continuous analytical instrumentation on the process stream itself. Though the initial cost of the instruments is high, the savings in laboratory manpower and the possibilities of increased plant operating efficiencies resulting from their use permit the initial investment to be paid off in a very short period (Paul A. Wilks, Jr., Perkin-Elmer Corporation, Norwalk, Conn.).

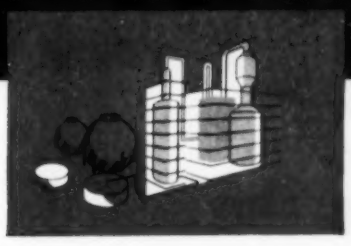
... **Mass** spectrometry has been known for many years but up to the present time has been of only academic interest to the LPG industry. As LPG manufacturing and distribution is spread thinly rather than being concentrated in high capacity facilities, sample loads for analysis at any one location are usually light to moderate. Conventional size mass spectrometers represent too much instrumentation investment for the relatively limited needs of the LPG industry. However, with the recent advent of small mass spectrometers, the picture has changed completely. These instruments are capable of producing nearly all the analytical data required for LPG products, either on a continuous basis or as batch assays. Their initial cost is low enough to make them favorably competitive with other analytical methods (A. P. Gifford, Consolidated Engineering Corporation, Pasadena, Calif.).

... **By the use** of ultraviolet absorption a rapid method has been developed for the determination of free sulfur in liquefied petroleum gas. This method requires approximately 20 minutes elapsed time to determine the free sulfur in LPG in the range of 0-20 p.p.m. H_2S in concentrations below 0.1% by weight does not interfere, nor do normal amounts of mercaptans and odorants. The indicated accuracy is about plus or minus 0.5 ppm (J. F. Hickerson, W. B. Lewis and B. J. Davidson, Humble

Who's Meeting . . .

Stauffer Chemicals for the...

Petroleum Industry



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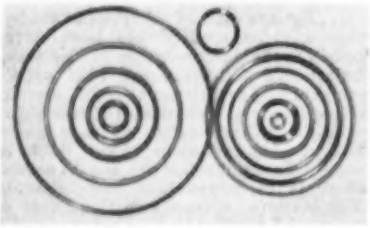

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Who's Meeting . . .

Oil & Refining Company, Baytown, Texas).

. . . **An instrument** for measuring and recording hydrogen sulfide in air and other gases in the concentration range of 0 to 100 ppm has been developed. The instrument is based upon the use of special film prepared by coating blank 16-mm motion-picture film with buffered lead acetate. The sample in gaseous form is pumped continuously through an exposure hood, where hydrogen sulfide reacts with the film coating to form a stain. Light through the stained film falls on a photoelectric cell and generates an electric current inversely proportional to the hydrogen sulfide concentration. This current operates a conventional electronic recording potentiometer. A warning alarm may be made to sound automatically at any predetermined concentration of hydrogen sulfide (E. B. Offutt, Robertshaw-Fulton Controls Company, St. Louis, and L. V. Sorg, Standard Oil Company (Indiana), Sugar Creek, Mo.).

. . . **An instrument** has been developed for the complete analysis of LP gases which is based on the preferential adsorption of the gases on a highly activated surface and subsequent identification and measurement of the separated gases. The time of analysis may vary from 15 to 30 minutes for the very rapid routine determinations to 60 or 90 minutes for more accurate results (Lloyd V. Guild, Burrell Corporation, Pittsburgh, Pa.).

ASTM at Cleveland . . .

. . . **A Symposium on European Developments in the Testing of Transformer Oil** will be held on Wednesday evening, November 17, at the Carter Hotel in Cleveland, in conjunction with the fall meeting of ASTM Committee D-9 on Electrical Insulating Materials. This will be the sixth session of a series of Symposia on Insulating Liquids to be held in recent years. All of these symposia have related to methods of test and the interpretation of test data to evaluate the properties and performance of insulating liquids. The proceedings at all the sessions have appeared in ASTM publications.

The November symposium will comprise the following three papers by authors from England, France, and Sweden:

- "Method of Evaluation of Inhibited Insulating Oils," by Irving and Bravey, England.
- "Methods of Evaluating New and Used Insulating Oils as Applied in France," by T. Salomon, France.
- "Catalysts for Accelerated Aging Testing of Transformer Oil," by Liander and Ericson, Sweden.

It is generally recognized that the Europeans have been very aggressive in developing and improving insulating oil technology, which would indicate that this will be a very interesting program and a very valuable contribution to the symposium series.

In the Future

. . . **The Third** Annual Instrumentation Conference to be held at the Louisiana Polytechnic Institute, Ruston, La., has been set for November 4 and 5. The conferences are sponsored by the School of Engineering.

CALENDAR OF MEETINGS

11–13	American Gas Association (36th Annual Convention), The Traymore Hotel, Atlantic City, N.J.
12–15	Eighth National Chemical Exposition, Chicago Coliseum, Chicago.
14–15	National Association of Corrosion Engineers (South Central Regional Meeting), Dallas, Texas.
17–20	American Institute of Mining and Metallurgical Engineers (Fall Meeting, Petroleum Division), Plaza Hotel, San Antonio, Texas
18–22	National Safety Council, Chicago.
21–22	Western Petroleum Refiners Association (Regional Meeting), Garrett Hotel, El Dorado, Ark.
22	American Institute of Chemical Engineers, South Texas Section (Annual Technical Meeting), Galvez Hotel, Galveston, Texas.
25–27	National Lubricating Grease Institute (Annual Meeting), Mark Hopkins Hotel, San Francisco, Calif.
25–29	American Institute of Electrical Engineers (Fall General Meeting), Chicago.
29	Natural Gasoline Association of America (Southern Regional Meeting), Blackstone Hotel, Tyler, Texas.
NOV.	
3– 5	The Society of Rheology (Annual Meeting), National Bureau of Standards and Sheraton Park Hotel, Washington, D.C.
4– 5	Instrument Conference (Third Annual), Louisiana Polytechnic Institute, Ruston, La.
4– 5	Society of Automotive Engineers (National Fuels and Lubricants Meeting), Mayo Hotel, Tulsa, Okla.
8–11	American Petroleum Institute (34th Annual Meeting), Conrad Hilton Hotel and Palmer House, Chicago.
15–17	American Standards Association (Annual Meeting), Roosevelt Hotel, New York.
18–19	National Association of Corrosion Engineers (Western Regional Conference), Los Angeles.
18–19	Ninth Midwest Quality Control Conference, Baker Hotel, Dallas, Texas.
28 to Dec. 3	American Society of Mechanical Engineers, Statler Hotel, New York.
Dec.	
2– 7	National Exposition of Power and Mechanical Engineering, Commercial Museum, Philadelphia.
3	Natural Gasoline Association of America (Panhandle-Plains Regional Meeting), Herring Hotel, Amarillo, Texas.
8–10	Oil Industry Information Committee, Waldorf-Astoria, New York.
12–15	American Institute of Chemical Engineers (Annual Meeting), Statler Hotel, New York.
JAN. 1955	
10–14	SAE Golden Anniversary (Annual Meeting), Sheraton-Cadillac and Statler Hotels, Detroit.
26–28	Symposium on Instrumentation for the Process Industries, Agricultural and Mechanical College of Texas, College Station, Texas.
FEB.	
13–18	ASTM Committee D-2 on Petroleum Products and Lubricants, Rice Hotel, Houston.
25	Natural Gasoline Association of America (Regional Meeting), Scharbauer Hotel, Midland, Texas.
MAR.	
7–11	National Association of Corrosion Engineers, (Annual Conference and Exhibition), Palmer House, Chicago.
APRIL	
13–15	Natural Gasoline Association of America (Annual Convention), Baker and Adolphus Hotels, Dallas, Texas.
13–15	American Society of Lubrication Engineers (Annual Meeting and Lubrication Exhibit), Hotel Sherman, Chicago.

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What's Happening in the Industry . . .

NPC Sets Meeting to Clear Committee Studies

Agenda of the meeting of the National Petroleum Council called for this month will include the completion of some of NPC's seven committee studies now under way.

Reports are expected from groups studying: storage, radio and radar use in oil and gas industries, tribute to PAD, and government personnel (staffing of the oil and gas division.)

Still in the doubtful stage are reports from the committees on shale oil policy and on productive capacity.

Forthcoming from the committee studying means of dealing with petroleum and gas industry crises that might occur during an enemy attack and means of post-attack rehabilitation is probably only a progress report. This committee has recently appointed subcommittees on continuity of company operations and advance preparations and plans. Named to head the subcommittee on continuity as chairman was H. G. Mangelsdorf, Esso Standard Oil Company. R. G. Arner, Sinclair Oil Corporation, was appointed chairman of the subcommittee on advance planning.

Swearingen Warns of Dangers of Depletion Cut

The U. S. oil industry can possibly suffer more from the many proposals to cut the oil and gas depletion allowance than it now does from continuing high foreign crude imports.

This, in essence, is what J. E. Swearingen, vice president for production, Standard Oil Company (Indiana), told a U. S. Chamber of Commerce natural resources committee recently in a report on the "Outlook for Petroleum Industry, 1954-1955."

Swearingen said industry is in good health after a 1954 period of adjustment "similar to the experience of many other industries" and "fortunately, our adjustment has not been too severe." Through 1955, he said, the outlook is encouraging, although U. S. crude oil producing industry will operate at only 75 percent capacity.

Kendall Refining Names Two New Vice Presidents

Two vice presidents have been appointed at The Kendall Refining Company.

Howard V. Smith, who has been a member of the board of directors, was named vice president in charge of refining. Smith joined the Kendall organization in 1943 as refinery manager. Prior to joining Kendall, he was assistant superintendent of refining for Skelley Oil Company.

G. Harold Osborne was named vice president in charge of marketing. He has been a member of the board of directors since 1951.

Topflight Speakers Scheduled For Annual API Chicago Meet

Two new features have been added to the program of the 34th annual meeting of the American Petroleum Institute to be held in Chicago, November 8-11.

A symposium on measuring, sampling, and testing crude oil and petroleum products, will cover the past, the present, the future and management's attitude toward the whole program. It has been added in recognition of the time, effort, manpower and dollars involved in this phase of operations.

A group session on petroleum statistics, will have financial implications, with both speakers—Allyn P. Evans, president of Lionel D. Edie and Company, New York, and Economist John W. Boatwright, of Standard Oil Company (Indiana)—giving commentaries and forecasts on economic problems.

All sessions will be housed in the Conrad Hilton Hotel except those of the API Division of Transportation, which again will be in the Palmer House.

Speakers—Heading the list of speakers are Secretary of Interior Douglas McKay, who is also the nation's Petroleum Administrator for Defense; Deputy Secretary of Defense Robert B. Anderson, and General Lucius D. Clay.

Secretary McKay will address the general session on Wednesday morning, November 10. Deputy Secretary Anderson and General Clay, chairman of the board of Continental Can Company, will speak at the second general session on Thursday morning.

Other speakers include M. J. Rathbone, president and a director of Standard Oil Company (New Jersey), W. M. Vaughey, president of the Independent Petroleum Association of America, and Frank M. Porter, API president.

Gold Medal—P. C. Spencer, president of Sinclair Oil Corporation, and chairman of the API directorate, will preside at both general sessions. He will make the formal presentation of the API Gold Medal for Distinguished Achievement to this year's recipient, whose identity is yet to be announced. The gold medal is regarded as one of the nation's top industrial awards.

Highlights—The four-day program at Chicago will include group sessions on fundamental research, public relations, refining, measurement, marketing, transportation, lubrication, safety, and fire protection.

David Rockefeller will address the refining session Monday afternoon, November 8. John W. Newton, Magnolia Petroleum Company, and API vice president for refining, will preside.

Featured speaker at the public relations sessions will be Robert F. Kennon, governor of Louisiana.

API Business—The API board of directors will meet all day Tuesday and again on Wednesday. Among new officers to be elected this year are three vice presidents—for production, refining and marketing. The Institute's newly elected executive committee (for 1955) will meet at noon on Thursday. The board of councillors will meet Tuesday morning to nominate candidates for election to the 1955 board of directors.

McCray Heads Changes in Texaco's Refining Staff

Howard S. McCray has been appointed manager of operations of The Texas Company's Refining department. He was formerly superintendent of Texaco's refinery at Lockport, Ill. In other appointments announced:

McCray

Eddins W. McNealy, former superintendent at Eagle Point, Westville, N. J., was named superintendent at Lockport.

Robert H. Aitken, former assistant superintendent at Eagle Point, was appointed superintendent of the refinery.

Horace H. Chandler, former assistant superintendent of manufacturing at the Port Arthur, Texas, refinery, was named assistant superintendent at Eagle Point.

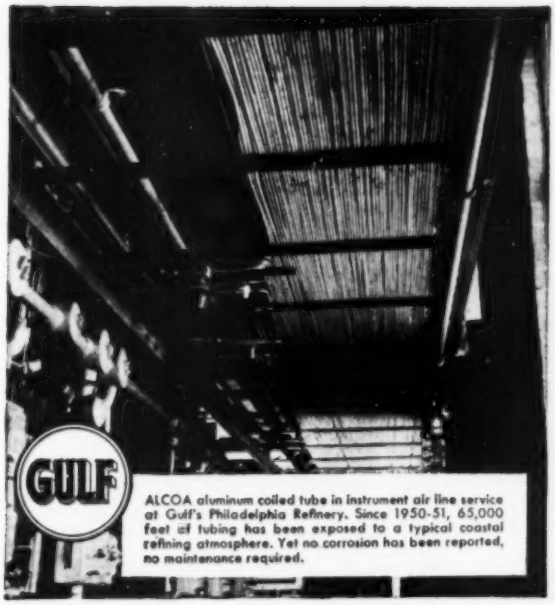
Purchasers Schedule Meet In Chicago During API

Members of the Petroleum Industry Buyers Group of the National Association of Purchasing Agents will hold their semi-annual meeting in Chicago November 9, in conjunction with the yearly gathering of the API.

Headlining the purchasers' program will be B. Brewster Jennings, president of Socony-Vacuum Oil Company, who will speak on "What Management Expects of Purchasing Agents." Other speakers are scheduled.

Stanolind Takes RFC Debt

Stanolind Oil & Gas Company has assumed the $17.7 million Reconstruction Finance Corporation obligation of Carthage Hydrocol, Inc., according to RFC, which is being liquidated by congressional edict. Under Stanolind's agreement with RFC, it has acquired all stock of Carthage Hydrocol and assumed the obligation to RFC.



ALCOA aluminum coiled tube in instrument air line service at Gulf's Philadelphia Refinery. Since 1950-51, 65,000 feet of tubing has been exposed to a typical coastal refining atmosphere. Yet no corrosion has been reported, no maintenance required.

Gulf Oil Corporation cuts cost and corrosion with ALCOA UTILITUBE®

Like Gulf, you too can save from 30 per cent to 60 per cent in tube costs because ALCOA Utilitube costs from 30 per cent to 60 per cent *less* than copper. It has excellent on-the-job forming and flaring properties . . . is available in economical, long lengths up to 1,000 feet or more, depending on size. It stands up well under vibration . . . has high resistance to most industrial atmospheres and to many liquids and gases.

In petroleum service, Alcoa Utilitube will not form sludge or gum . . . will not discolor or contaminate the fluid it carries.

Use Alcoa Utilitube for:

- ★ Pneumatic control circuits
- ★ Gasoline and fuel oil for internal combustion engines
- ★ Lubricating oils for engines and machines
- ★ Fluids for hydraulic systems.

For complete details, write for the new booklet: *Alcoa Utilitube*

ALUMINUM COMPANY OF AMERICA
905-K Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Cosden Petroleum Corporation cuts costs and corrosion with ALCOA UTILITUBE*

45,000 feet of ALCOA Aluminum Coiled Tube in instrument air service at Cosden's BTX Plant, Big Spring, Texas. Partially exposed to hydrogen sulfide gas, tubing shows no corrosion, has required no maintenance since installation in mid-1952. Installation designed and licensed by Universal Oil Products Company and built by Procon, Inc.

This company found that ALCOA UTILITUBE* is the lowest cost corrosion-resistant tube you can buy—*up to 40 per cent less than other corrosion-resistant metals.* It gives you three times more feet per pound. It is easier to form, flare and bend than annealed copper. It will not gum, sludge or discolor the fluids it carries.

Alcoa Utilitube comes in standard 50 and 100 foot lengths and in economical, long lengths up to 1,000 feet in some sizes.

Alcoa Utilitube is designed to handle fuel and lubricants in engines, air in instrument systems, fluids in hydraulic systems, cutting compounds in machine tools, etc. For complete information, write for the booklet, *Alcoa Utilitube.*

ALUMINUM COMPANY OF AMERICA
905-K Alcoa Building, Pittsburgh 19, Pa.

*Registered Trademark, Aluminum Company of America

ALCOA ALUMINUM

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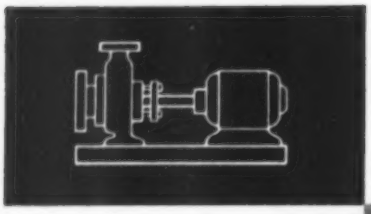
For more data on advertised products, use Readers' Service Cards, last page.



What do pump manufacturers and pump users say about Sealol-Flexibox Mechanical Shaft Seals? Do these shaft seals stand up? Do they prevent leakage under rigorous conditions? Are they safe? Let these typical cases speak for Sealol-Flexibox . . .

LET'S GET DOWN TO CASES...

MAY 4, 1953

Leading pump manufacturer orders eleven Sealol-Flexibox Seals for following applications: Butane and lighter fractions at 580 psig.; liquified petroleum gases at 190 psig.; ethylene and ethane at 480 psig.; rich oil at 560 psig.; liquified petroleum gases at 150 psig.; caustic solution at 585 psig.

NOV. 3, 1953

Major oil refinery "enthusiastic" over performance of Sealol-Flexibox Seal on butane pump (1¾"shaft) at pressures to 400 psig.

MAY 16, 1953

World famous petroleum processing and refining organization standardizes on Sealol-Flexibox Mechanical Shaft Seals for new and existing pumps.

FEB. 11, 1953

Refinery so satisfied with performance of Sealol-Flexibox Seal on propane pump operating at 263 psig. they are now substituting Sealol-Flexibox Seals for those presently fitted on other pumps.

JUNE 9, 1953

Oil refinery reports very satisfactory performance of Sealol-Flexibox Seals handling propane at pressures as high as 420 psig. suction pressure — and 555 psig. delivery pressure.

APRIL 10, 1953

Refinery reports highly satisfactory performance of approximately 60 Sealol-Flexibox Seals in continuous operation since the summer of 1951, handling a large variety of fluids, including Dowtherm at 425°F.

If you have shaft sealing problems, it will pay you to find out about Sealol-Flexibox Mechanical Shaft Seals for process pumps. Write for Bulletin 9, or send details for engineering recommendations.

SEALOL

Sealol Corporation, 13 Willard Ave., Providence 5, R. I. Chicago, Cleveland, Los Angeles, Houston, Philadelphia, Kansas City, Charleston, W. Va.

THE ▲ BALANCED PRESSURE SEAL

What's Happening. . .

Elections will take place at the Wednesday morning general session.

Sessions—Other sessions with chairmen include:

Monday, November 8—Group session, Fundamental Research, H. W. Field, advisory committee, The Atlantic Refining Company. Presentation of API "Certificate of Appreciation," Robert E. Wilson, Standard Oil Company (Indiana). Research on Composition and Properties of Petroleum: Reports on seven investigations currently in progress on various phases of this fundamental research.

Group Session, Public Relations, H. S. M. Burns, Shell Oil Company. Oil Industry Information Committee Report, G. Stewart Brown, Standard Oil Company of California. "Industry Must Speak Up," Hon. Robert F. Kennon, governor of Louisiana.

Group Session, Division of Refining, John W. Newton. Report of Division's Nominating Committee, W. W. Scheumann, Cities Service Research and Development Company; Election of the General Committee of the Division of Refining, and an address by David Rockefeller, New York.

Tuesday, November 9—Group Session, Financial and Accounting, Max Lorimore, Union Oil Company of California. Morning session: "Taxation and Economic Progress," P. W. McCracken, University of Michigan; and an address by Robert G. Dunlop, Sun Oil Company. Afternoon session: "Accounting Is an Operating Tool," Lorimore, and "Shifting Balance of Forces in '55," Edwin B. George, economist, Dun and Bradstreet.

Wednesday, November 10—General Session, P. C. Spencer, Sinclair Oil. Report of Board of Councillors and Election of Directors. Presentation of Gold Medal for Distinguished Achievement. Addresses: M. J. Rathbone, Standard Oil Company (New Jersey); and Hon. Douglas McKay.

Group Session, Lubrication Session, R. Cubicciotti, L. Sonneborn Sons, Inc. Addresses: B. G. Symon, Shell Oil Company; P. V. Keyser, Jr., Socony-Vacuum Oil Company, Inc.; and Captain W. C. Latrobe, USN.

Group Session, Safety and Fire Protection, C. L. Hightower, United Gas Corporation. Addresses: Joseph P. Walsh, Sinclair Oil Corporation; and Stanley Learned, Phillips Petroleum Company. Discussion period to follow.

Group Session, Committee on Petroleum Statistics, Open Session, R. J. Gonzalez, Humble Oil & Refining Company. Addresses: on Near-Term Economic Outlook, Allyn P. Evans, Lionel E. Edie and Company; and on Certain Economic Questions Affecting the Petroleum Industry, John W. Boatwright, Standard Oil Company (Indiana).

Thursday, November 11—General Session, P. C. Spencer. Addresses: W. M. Vaughey, General Lucius D. Clay, and Hon. Robert B. Anderson.

Three Draw Appointments At Standard of Indiana

B. A. Vance has been appointed patent solicitor, T. E. Earle technologist, and B. P. Mann patent searcher in the Development and Patent department of Standard Oil Company (Indiana).

Vance, who joined the company's Research department in 1949, has been technologist in the Development and Patent department.

Earle joined the Research department in 1945 and has recently been assistant project chemist in the Specialty and Fuel Oils division.

Mann joined the Research department in 1951. He has been assistant chemical engineer in the Information division.

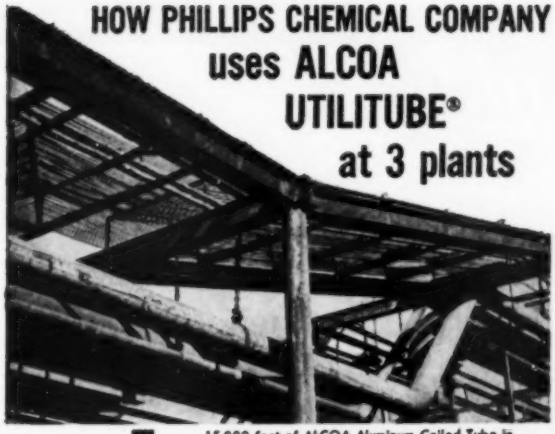
Foley and Lilley Made Directors of Texaco

James W. Foley and A. Neil Lilley, vice presidents of The Texas Company, have been elected directors.

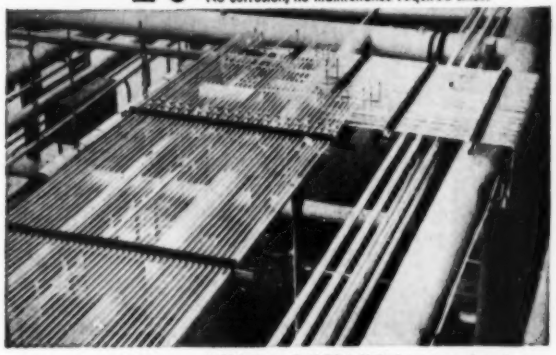
Foley, who joined the company in 1932, was elected a vice president in 1953. Lilley, who is vice president in charge of the Foreign Operations de-

For more data on advertised products, use Readers' Service Cards, last page.

HOW PHILLIPS CHEMICAL COMPANY uses ALCOA UTILITUBE® at 3 plants



1. 15,000 feet of ALCOA Aluminum Coiled Tube in exposed air line service (15 PSI) at Pyridine Plant, Pasadena, Texas. Installed summer, 1952. No corrosion, no maintenance required since.



2. 6,500 feet of ALCOA Utilitube serves dry air (75 PSI) to pneumatic controls and instruments at Philblack Plant, Borger, Texas. Installed, August, 1952. Exposed to H_2S since then. No corrosion, no maintenance.

3. (Not shown) 7,500 feet of ALCOA Utilitube has been serving air (20 PSI) to instruments at Goldsmith Sulfur Plant, Goldsmith, Texas, since January, 1952. Tubing has required no maintenance, is in excellent condition.

You, too, can *use Alcoa Utilitube to save money.* It's the lowest cost corrosion-resistant metal tube you can buy . . . may very easily cut your tube costs by 40 per cent.

Use Alcoa Utilitube for fuel and lube lines, for hydraulic fluids, for air and refrigerants. It will not gum or sludge in petroleum service; discolor or contaminate the fluid it carries.

Alcoa Utilitube forms, flares and bends as easy as annealed copper yet work hardens less. At sub-zero temperatures it actually gets stronger!

Alcoa Utilitube and Fittings are available from your aluminum distributor. For complete information, write for the booklet, *Alcoa Utilitube.*

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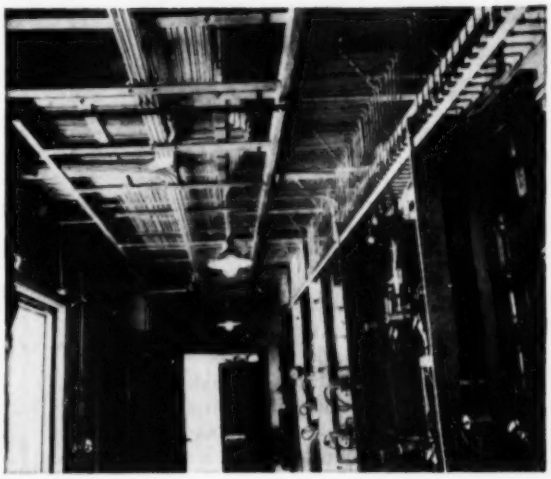
ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Montana refinery cuts cost 40% with ALCOA UTILITUBE®



50,000 feet of ALCOA Aluminum Coiled Tube serves air, dried by ALCOA Activated® Alumina, to the catalytic cracker and gas plant of Farmers Union Central Exchange, Inc. refinery, Laurel, Montana. Partially exposed to hydrogen sulfide and sulphur dioxide fumes, tubing shows no corrosion since installation in October, 1952.

USE ALCOA UTILITUBE TO SAVE MONEY. It's the lowest cost corrosion-resistant metal tube you can buy . . . may very easily cut your tube costs by 40 per cent!

USE ALCOA UTILITUBE for fuel and lube lines, for hydraulic fluids, for air and refrigerants. It will not gum or sludge in petroleum service, nor will it discolor or contaminate the fluid it carries.

ALCOA UTILITUBE forms, flares and bends as easy as annealed copper yet work hardens less. At sub-zero temperatures it actually gets stronger!

ALCOA UTILITUBE AND FITTINGS are available from your aluminum distributor. For complete information, write for the booklet: *Alcoa Utilitube.*

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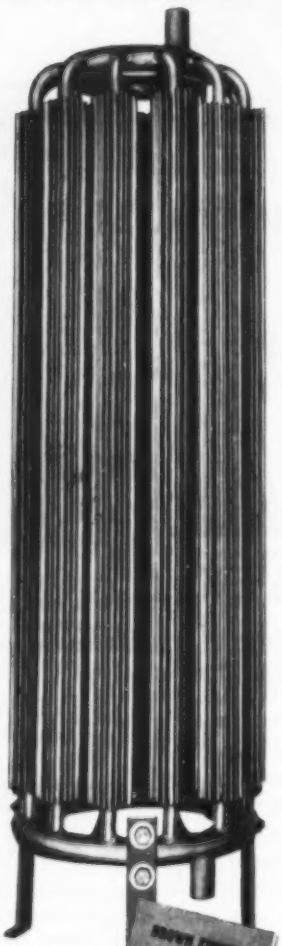
For more data on advertised products, use Readers' Service Cards, last page.

More tank heating for LESS MONEY!

CUT YOUR TANK HEATING COSTS WITH BROWN FINTUBE TF-18 TANK HEATERS



• Users report that our vertically mounted TF-18 Tank Heaters cost less **including the installation** than just installing old fashioned bare pipe coils in the bottom of a tank. Also, the vertical mounting prevents sediment from settling on the heating surfaces as when the old fashioned coil is used. This means more efficient, less costly heating. It avoids heating through a layer of sediment and leaves the tank floor uncluttered and easy to clean.

The finned construction provides approximately 7 times more heating surface per foot of tube length than plain bare pipe or tubing. Consequently, TF-18 Heaters transfer **more heat,** faster and at lower temperatures, avoiding coking or damage to heat sensitive materials. Easily installed in existing or new tanks. They **do not** require welding inside the tank. Tried, reordered and widely used by the country's leading petroleum and chemical concerns.

Time is short. You'll need tank heaters soon. Act today. Get full details about these new, fully proved, less costly tank heaters.

New fully descriptive Bulletin No. 541 gives dimensions and full details. Write for your copy today.

Brown Fintube Co. *Elyria, Ohio*

NEW YORK • BOSTON • PHILADELPHIA • PITTSBURGH • BUFFALO • CLEVELAND • CINCINNATI • DETROIT
CHICAGO • ST. PAUL • ST. LOUIS • KANSAS CITY • MEMPHIS • BIRMINGHAM • NEW ORLEANS
SHREVEPORT • TULSA • HOUSTON • DALLAS • DENVER • LOS ANGELES • SAN FRANCISCO
BROWN FINTUBE (CANADA) LTD., ST. THOMAS, ONTARIO, CANADA
BROWN FINTUBE (GREAT BRITAIN) LTD., BIRMINGHAM, ENGLAND
FRIEDRICH UHDE, GMBH, DORTMUND, GERMANY

What's Happening. . .

partment—Eastern Hemisphere, joined Texaco in 1933. He was elected a vice president in 1951.

Lyman Becomes President Of California Research

A. L. Lyman, formerly executive vice president of California Research Corporation, a subsidiary of Standard Oil Company of California, has been promoted to president of the research company.

Lyman

Lyman succeeds H. G. Vesper, who has been assigned to direct marketing, supply and transportation for the parent company in the Western area.

Lyman joined Standard in 1924, became manager of its Richmond laboratories in 1938 and a director of Cal Research in 1944. He became executive vice president in 1953.

Huber Elected Chairman Of OICC for Next Year

W. R. Huber, general manager of public relations for Gulf Oil Corporation, Pittsburgh, has been elected chairman of the National Oil Industry Information Committee for 1955.

Huber has been a member of the National Information Committee since its inception in 1947. During the past three years, he has been chairman of the subcommittee on advertising. He will take office in December, succeeding G. Stewart Brown, manager of public relations for Standard Oil Company of California.

The following vice chairmen were elected: J. H. Sembower, Shell Oil Company, San Francisco; Roy M. Stephens, Humble Oil & Refining Company, Houston; L. R. Kamperman, Leonard Refineries, Alma, Mich.; Kerryn King, The Texas Company, New York; Richard Rollins, The Atlantic Refining Company, Philadelphia.

John S. Cooke, of the American Petroleum Institute, was re-elected secretary.

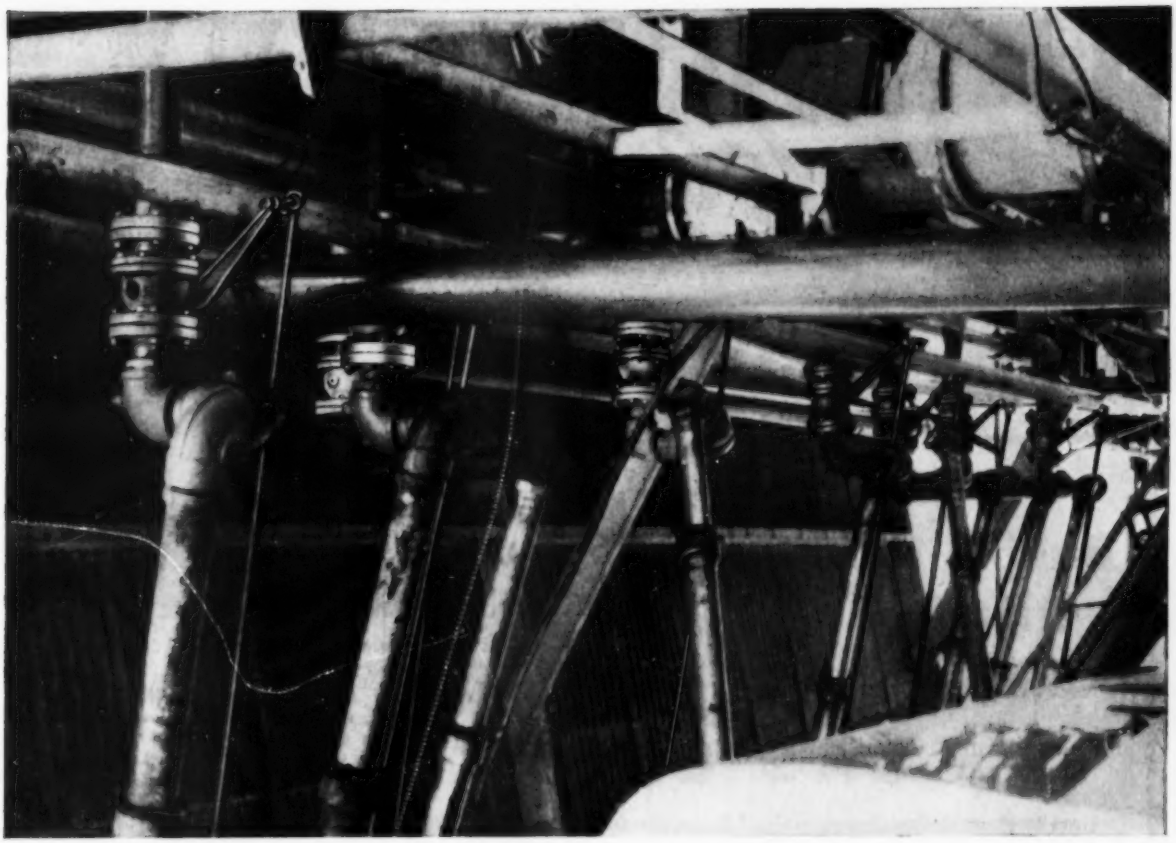
Employes Set Safety Mark

Employes of the Whiting, Ind., research laboratories of Standard Oil Company (Indiana) have set an all-time safety record for the laboratories and their record is still growing.

More than 4,300,000 man-hours without lost-time accident have been worked since August 14, 1952. The previous safety record for the Whiting laboratories was 4,019,863 man-hours from 1946 to 1949.

Underground Stocks Up

The Bureau of Mines, U. S. Department of the Interior, has reported that underground stocks of LPG on July 31 totaled 255 million gallons. This repre-



Busiest loading rack in the Midwest relies on Rockwood Ball Valves

Day in, day out, twenty-four hours a day, the fuel loading rack above fills tank trucks — in record time.

Eight Rockwood Ball Valves perform this grueling operation, opening and closing in trigger time — permitting a full, round flow of fuel — and preventing dangerous oil sludge on the loading pavement by remaining absolutely leak-proof.

What makes Rockwood Ball Valves so outstanding? These four exclusive features assure trouble-free efficiency:

Full Round Flow — no change in shape or volume of fluid stream — no turbulence — no minimum loss.

Quick Opening and Closing — only a quarter turn needed, even under full pressure.

Longer Wear-Resistance — chrome-plated bronze ball withstands abrasion, pitting and scratching.

Leakproof Seal — pressure of fluid automatically positions ball against seat to form tight seal.

If you are not now using Rockwood Ball Valves, send coupon today for complete information. Valves come in all pipe sizes. Tested and listed by Underwriters' Laboratories, Inc.

ROCKWOOD BALL VALVES

FULL, ROUND FLOW

ROCKWOOD SPRINKLER COMPANY
570 Harlow Street
Worcester 5, Mass.

Send me illustrated folder V-4 on Rockwood Full-Flow Ball Valves.

Name .....

Title .....

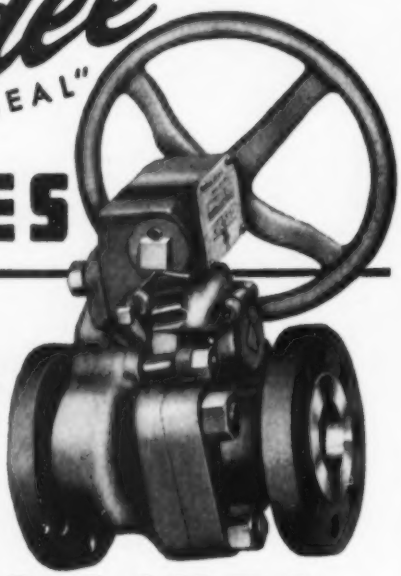
Company .....

City .....

Zone ..... State .....

For more data on advertised products, use Readers' Service Cards, last page.

APPROVED Okadee "PERFECT SEAL" VALVES



for Bubble-tight Primary Shut-off in L P GAS LINES

Underwriters' Laboratories, major LP gas producers*, and Liquified Petroleum Gas Commissions of several States* approve Okadee Valves for primary shut-off in LP gas lines. In addition, Okadee Valves are used in virtually all types of gas and liquid lines at pressures to 600 p.s.i. and temperatures to 800°F.—wherever a perfect seal, low maintenance and long life are necessary.

Get complete data, including material specifications, on Okadee Valves — and newest Underwriters' Laboratories test report—without obligation, today.

**Names on request.*

- **A. S. A. Standard dimensions**
- **Sizes from ½" to 6"**
- **Single- and double-seated disc valves**
- **Hard-faced valves and seats . . . perfect metal-to-metal seal**
- **Self-cleaning, self-compensating valve discs**
- **Lever, rack-and-lever, or worm-gear operation**
- **Non-lubricated**
- **No wedge action**
- **Valves and seats wear in instead of "wearing out"**
- **All parts quickly replaceable in the field**
- **Inside and outside stem packing . . . double assurance against stem leaks**

Underwriters' Laboratories Reexamination Service Guide No. 141 A3.1.22, File MH5163. SL Screwed Type Series and Series 15 and 30 Flanged Type Okadee Valves are suitable as a positive shut-off in LP gas pipelines and other LP gas applications for a working pressure of 250 p.s.i.

Write for Bulletin No. 51FL

OKd. Okadee COMPANY
332 South Michigan Avenue • Chicago 4, Illinois

What's Happening. . .

sents an increase of 29 million gallons during the month. Stocks included 144 million gallons of propane, 79 million gallons of butane and 32 million gallons of butane-propane mixtures.

Standard Oil Development Expands Patent Licensing

Holt

Carlsmith

P. H. Holt 2nd has been put in charge of the expanded patent licensing activities of Standard Oil Development Company. He was previously an assistant director of Esso Laboratories Research division.

Dr. Leonard E. Carlsmith will be responsible for technical advice and contacts with licensees, contractors and engineering units of the company.

In the expansion, new emphasis is being placed on this phase of the firm's worldwide operations in view of the increasing number of major petroleum processes and inventions it has developed recently, including Fluid Coking, Fluid Hydroforming, Hydrofining and new versions of the Fluid Catalytic Cracking technique.

Kwinana Refinery Sets Date for Crude Arrival

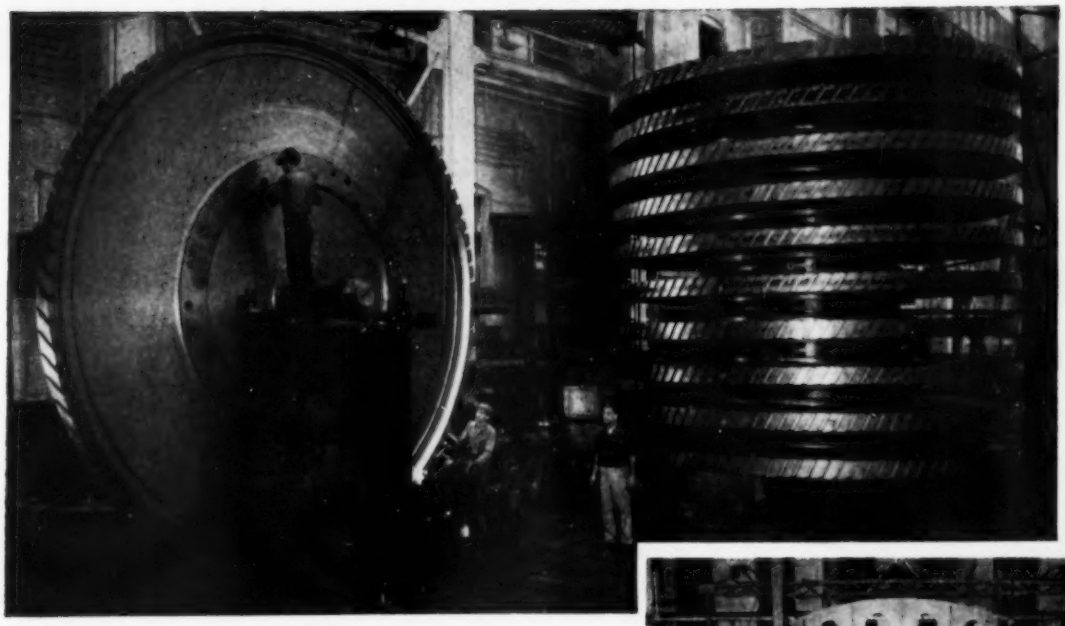
Crude oil from the Persian Gulf is scheduled to start arriving at the new refinery of Australasian Petroleum Industry, Ltd., at Kwinana, Australia, near Fremantle, shortly after January 1, 1955.

The first shipload of crude will reach the installation at that time even though refinery operations are not expected to begin until some months later. Crude oil brought from Kuwait by a fleet of Anglo-Iranian Oil Company tankers will be stored in huge tanks which have been erected on the 950-acre site until the refinery is ready for production.

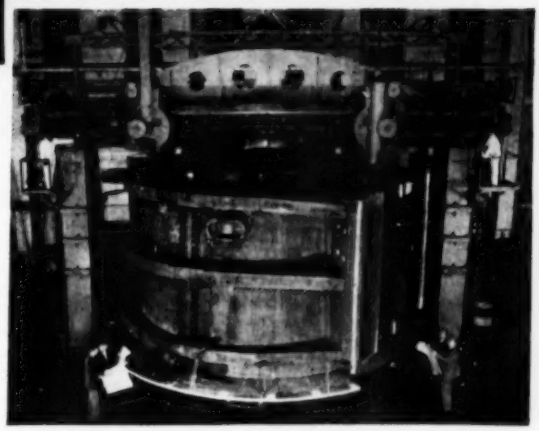
The new plant will likely be commissioned before July, 1955. It is capable of handling about 60,000 barrels a day of crude oils. At the request of the West Australian government, the refinery will produce bitumen as a by-product.

Esso Man Wins $5000

The largest award ever granted by Esso Standard Oil Company under its "Coin Your Ideas" plan last month went to Walter Mason, of Linden, N. J. Mason received $4750, representing a supplemental award payment for his suggestion to provide additional settling



Rotor discs for mammoth 11-stage compressor were balanced and stacked for alignment in one of Newport News' five huge machine shops. Large engineering and technical staffs with a vast plant make Newport News an ideal source for large equipment . . . *standard or special in design.*



A 35-foot boring mill in Newport News' plant machining the 374,000-pound upstream housing for the giant axial flow compressor. The compressor is heart of an 8-foot supersonic wind tunnel at the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics at Moffett Field, Calif.

To create winds exceeding

2000 MPH

Newport News builds world's Mightiest Compressor

Whenever you want large units built with careful attention to detail, give the job to Newport News.

This company recently built an eleven-stage axial flow compressor that shatters all previous records for wind force . . . using what is believed to be the world's largest rotating object.

The rotor, weighing more than 400 tons, comprises eleven huge discs. Each disc, machined from a 96,000-pound forging, was finished to a 50,000-pound wheel and balanced to within 26 ounces at the rim. In each rim, slots for blades were machined to within .005" on special milling heads designed and produced in the Newport News plant.

Here at Newport News, you'll find more than large productive capacity. In machine shops, foundries and forging plants Newport News craftsmen complete your orders with specialized techniques backed by experience in fabricating thousands of products.

Newport News' craftsmen produce units that range from small components of spinning machines, to mammoth hydraulic turbines . . . from piping, pumps and valves, to vacuum tanks, digesters and bridge caissons.

These skilled men handle the job exactly as you want it done, for maximum results per dollar invested. So let us bid on your present or future projects. Learn how Newport News can help you. Send for our illustrated booklet entitled, "Facilities and products" . . . it's yours for the asking.

Newport News

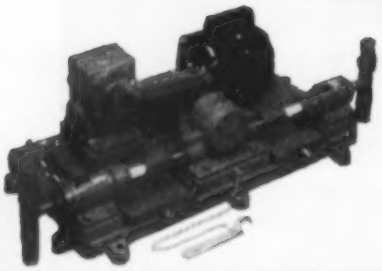
Shipbuilding and Dry Dock Company

Newport News, Virginia

For more data on advertised products, use Readers' Service Cards, last page

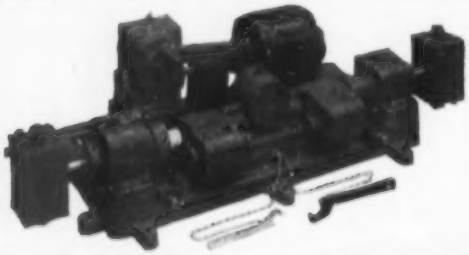
If you meter or proportion small volume flows...

THERE IS A HILLS-McCANNA "U" TYPE PUMP TO DO THE JOB



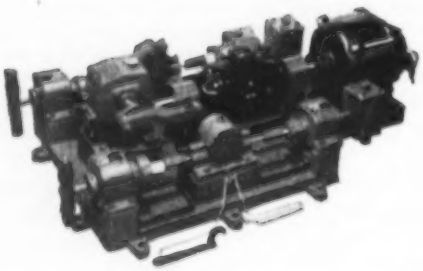
STANDARD 1, 2, 3 or 4 FEED UNITS

Standard "U" Pumps are available in maximum capacities from 0.10 to 24.0 gal. per hr. per feed. Operating pressures from 125 to 5000 psi.



JACKETED UNITS

For handling materials that require heat or refrigeration, "U" Pumps can be supplied with either or both jacketed liquid ends and check valves.



VARIABLE SPEED UNITS

"U" Pumps can be furnished with a variable speed drive which permits varying capacity remotely or automatically when combined with the proper auxiliary equipment.

Write for Catalog:

Catalog UP-52R gives full data on all sizes and types of Hills-McCanna "U" Type Pumps. Write for a copy, today. Hills-McCanna Co., 2441 W. Nelson St., Chicago 18, Ill.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of:

SAUNDERS TYPE DIAPHRAGM VALVES

FORCE FEED LUBRICATORS • MAGNESIUM ALLOY SAND CASTINGS

What's Happening...

facilities for caustic soda treating operations of heating oils. An initial award of $250 was previously paid for his suggestion. Mason is an operator in the treating operations at Esso.

General Petroleum Names Chief Design Engineer

Leo A. Castler has been advanced to chief design engineer in the Engineering department of General Petroleum Corporation.

Castler

Castler, who joined the company in 1943 as a senior draftsman, will report directly to F. C. King, assistant manager at the Torrance, Calif., engineering offices. Castler became a job engineer in 1947 and a project engineer, his former post, in 1951.

During World War II he served with the U. S. Army Engineers, assisting in the design of a new refinery in Canada.

Sherwin Gets Appointment To New Government Post

Douglas S. Sherwin, who has been on loan service to the U. S. government from Phillips Chemical Company since August, 1952, has been appointed secretary of the Federal Facilities Corporation, the agency which administers the government's Synthetic Rubber and Tin Programs.

Previously, Sherwin was to have returned to Phillips in July. In order that he could accept the new appointment, Phillips Chemical extended the period of his loan service to the government.

Indiana Standard Revamps Manufacturing Department

Standard Oil Company (Indiana) has announced a reorganization of engineering operations in its Manufacturing department and the appointment of five top engineering executives to new positions.

Under the new setup a General Engineering department has been established to serve all six of the company's refineries in the Manufacturing department. It will estimate, develop, design, and supply engineering supervision for construction of major facilities and will coordinate engineering operations.

Named director of engineering and engineering research was G. W. Watts, director of engineering since 1945. He will remain at Standard's general office in Chicago.

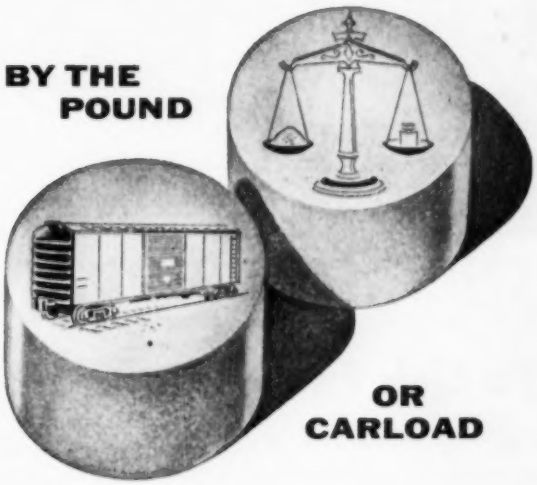
F. W. Scheineman, chief engineer, manufacturing, since 1951, was appointed manager of the General Engineering department.

G. M. Keranen was named the new department's assistant manager for construction, coordination, and contracts. W. G. Guild was appointed assistant manager for design engineering. Both

HARSHAW PRODUCES

CATALYSTS

BY THE POUND



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HARSHAW CATALYSTS AVAILABLE IN 7 FORMS:

- Tablets
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- Powders
- Spheres
- Granules
- Rings
- Flakes

Harshaw has facilities for producing your catalysts in any quantity, whether measured in pounds or tons. If you are in the experimental or development stage and need only a few pounds of your catalyst, call for Harshaw's technical assistance; if you are in the production stage, call on us to produce any amount of catalyst you need. Your specifications will be met . . . exactly. And Harshaw's ability to produce will provide the catalyst . . . when you want it. If your mind's on catalysts, call Harshaw today.

Our booklet, "Harshaw Catalysts" is yours for the asking.

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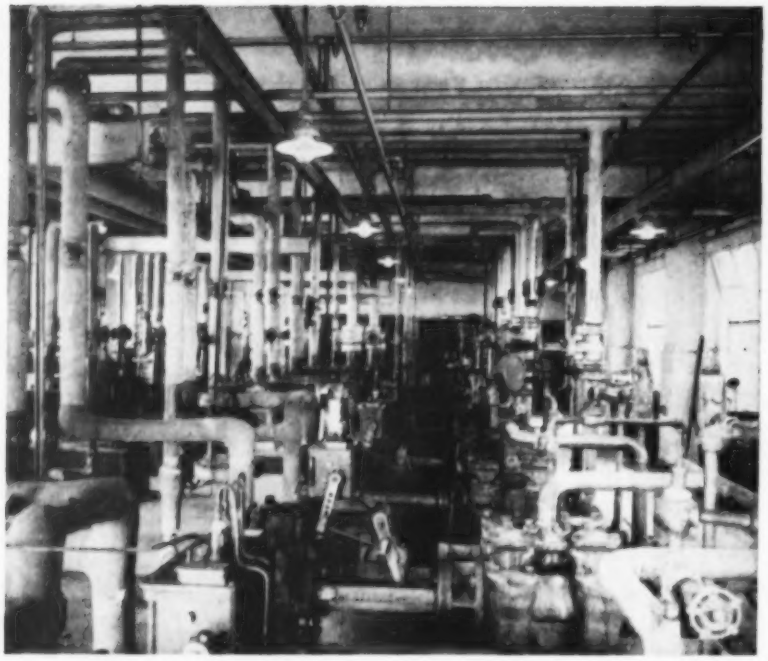
Cleveland 6, Ohio
Detroit 28, Mich.
Houston 11, Texas
Los Angeles 22, Calif.
New York 17, N. Y.
Philadelphia 48, Pa.
Pittsburgh 22, Pa.

HARSHAW

For more data on advertised products, use Readers' Service Cards, last page.



ENGINEERED PROTECTION

To Lick Fire—Maintain Profits!

Close inspection reveals much more than meets the eye in this petroleum refinery pump room. "Automatic" FIRE-FOG protection, ENGINEERED to this specific risk, is ready at all times to detect and extinguish fire, should it threaten to destroy property, halt production, reduce profits.

This is but one type of a wide variety of fire-fighting systems designed, manufactured and installed by "Automatic" Sprinkler Corp. of America. Others employing AIR FOAM, high or low pressure CO_2, Dry Powder, etc. stand guard over scores of petroleum and petro-chemical properties throughout the world.

The time to plan ENGINEERED "Automatic" FIRE PROTECTION is **before** fire strikes—not **after** fire has destroyed. Contact your nearest "Automatic" Sprinkler fire protection engineer for an appointment with a Safety First future. He'll gladly prepare a fire protection analysis for you without cost or obligation.

"Automatic" Sprinkler
CORPORATION OF AMERICA
YOUNGSTOWN, OHIO

Offices in Principal Cities of North and South America

What's Happening. . .

have been assistant chief engineers, manufacturing—Keranen since 1948 and Guild since 1952.

C. E. Evans, superintendent of the Projects division at the Whiting refinery since January 1, was appointed the new department's assistant manager for project engineering.

The General Engineering department will be stationed at the company's Administration and Engineering Building at Whiting. The same building will house the Whiting refinery's own Engineering division, with P. L. Krauel as chief engineer.

In the new General Engineering department, the company has made 25 appointments.

Named chief engineers for their respective divisions were these former assistant chief engineers from specialized departments in Standard's Whiting refinery:

A. T. Milbrook, Utilities Engineering division; W. K. Brown, Construction and Estimating; H. M. Romig, Process Engineering; and W. R. Burrows, Special Services.

Benjamin Franklin, assistant chief engineer for the Manufacturing department, was appointed chief engineer for the new department's Contracts division.

Sloan Haworth, assistant chief engineer of the Wood River, Ill., refinery, was named chief engineer of the Coordinating and Administrative division.

Head engineers from the Whiting refinery named to posts in the new department were F. B. Brueckmann, consulting engineer; F. A. Upson, assistant chief engineer of Process Engineering; J. C. Howard, assistant chief engineer of the Electrical Engineering department; K. C. Lowe, assistant chief engineer of the Construction department.

R. R. Penman, head engineer for Manufacturing Engineering, was named assistant chief engineer, Special Services.

K. L. Carter, assistant superintendent of the Utilities division at Wood River, was appointed assistant chief engineer of the Still and Hydraulic department.

C. E. Dyckman, former assistant chief engineer of the Whiting refinery's Estimating department, holds the same title in the General Engineering department.

Transferred from the Whiting refinery as head engineers in the General Engineering department were W. W. Bond and J. W. Cooper.

Whiting refinery personnel named as assistant head engineers of the new department were C. L. Ranck, G. A. Erickson, E. C. Hamman, Jr., G. A. Hankins, R. V. Nutt, C. A. Olson, A. C. Sampson, D. F. Sands, and C. L. Swift.

H. G. Kabbes, head engineer at Standard's Neodesha, Kan., refinery, also was named an assistant head engineer in the new department.

Utah Oil Now Delivering Jet Fuel to Boise Tank

Jet fuel is now being delivered from the Salt Lake City refinery of Utah Oil Refining Company to the new $150,000 jet fuel tank at Utah Oil's Boise, Idaho, terminal. A total of 798,000 gallons of jet fuel was included in the initial delivery.

The new jet storage tank has a

For more data on advertised products, use Readers' Service Cards, last page.

As a leading supplier of bubble caps, PSC not only offers a wealth of production know-how but also substantial economies. With dies on hand for 300 standard styles, PSC is saving many customers the cost of dies, as well as design and delivery time. Special caps to order. Some customers have effected maintenance economies with PSC units because we fabricate from any metal which will best meet their specific requirements: aluminum, brass, copper, nickel, carbon steel, any chrome or chrome-nickel stainless. For engineering data on the 300 standard styles SEND FOR CATALOG 54.

THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆

For more data on advertised products, use Readers' Service Cards, last page.

DEMONSTRATION... at the API Meeting!

The new Gilbarco Electronic Tank Gauge will be demonstrated *in actual operation* at THE API MEETING in Chicago, Nov. 7-11.

Place: Conrad Hilton Hotel
Suite: 826-A
Time: At your convenience

As a new, effective means of controlling inventories and stock losses, this new development of *electronic* measurement merits your close inspection. Drop in at Suite 826-A at any time.

OPENING NEW HORIZONS IN ACCURACY!

Now tank farms and refineries can maintain at least 100% greater accuracy with the new Gilbarco Electronic Tank Gauge. *No other tank gauge today* offers all these advantages for liquid measurement:

★ **Accurate** to 1/16 of an inch.

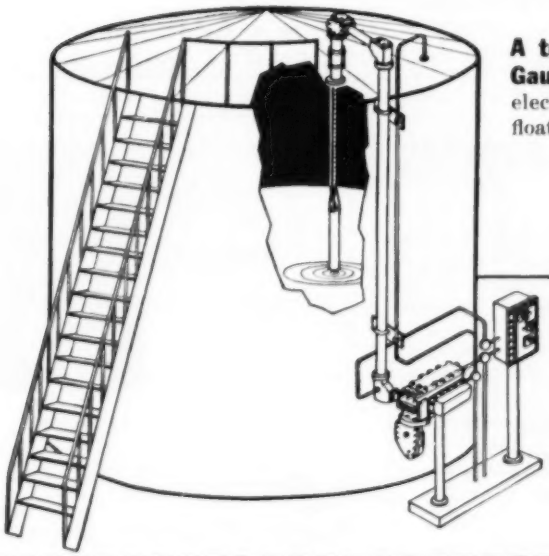
★ **Exterior Installation** and maintenance, without taking tank out of service.

★ **Not affected** by variations in specific gravity or viscosity.

★ **Can be used** in any type of low pressure tank.

★ **Can be supplied** with automatic switches and an instrument to indicate the average temperature of the product.

★ **Remote reading** equipment available for accurately transmitting temperature and liquid level data.



A truly Electronic Tank Gauge – actually *measures* electronically, not with a float!

For assured accuracy... get all the facts on the new Gilbarco Electronic Tank Gauge today!

GILBERT & BARKER MANUFACTURING CO.
West Springfield, Mass.

Please send us complete information on the Gilbarco Electronic Tank Gauge.

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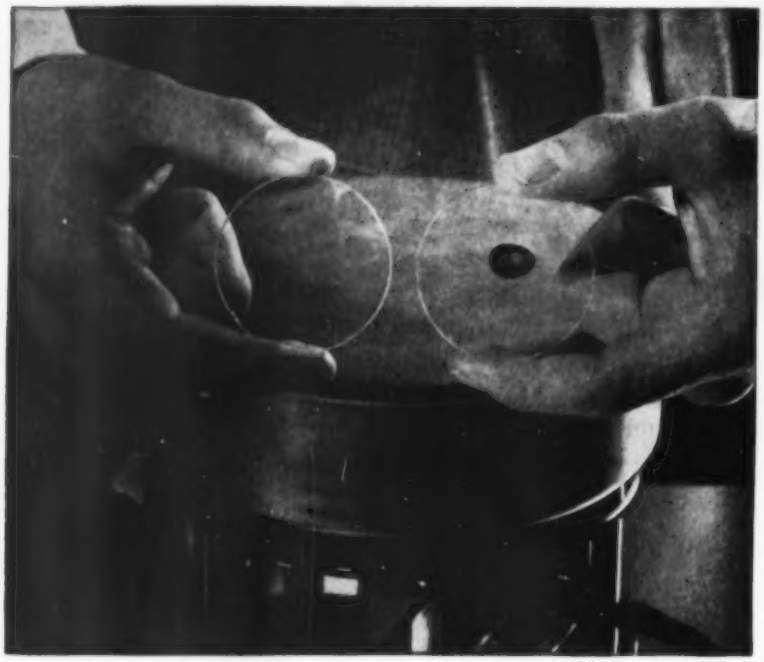
Try this simple test yourself...



dbpc® gasoline antioxidant reduces formation of induction system deposits in engines

● These glass discs show the results of an evaporation test made on **dbpc** inhibitor and another widely-used gasoline antioxidant. The **dbpc** (di-tertiary-butyl-paracresol), after evaporating to dryness, left no residue at all. Additive "A," however, left a dark residual film.

Either of these antioxidants, combined with gasoline, passing through an automotive induction system, could react just as they have in this simple experiment. **dbpc** also prevents the formation of gum in storage gasoline, another cause of induction system deposits. Moreover, it reduces harmful gum formation caused by gasoline as it passes through the intake system.

dbpc is safe and easy to handle—nontoxic and non-irritating. It is economical, highly soluble in gasoline, and is inert to extraction by the commonly used pipe line corrosion inhibitors.

It is also supplied in liquid form as Impruvol 33® antioxidant.

dbpc is only one of the many synthetic chemicals produced by Koppers. Others include Styrene Monomer, Polystyrene, Phthalic Anhydride, Divinylbenzene and Resorcinol. For further information, write to:

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Chemical Division, Dept. PR-104, Pittsburgh 19, Pennsylvania

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Koppers Chemicals

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · ATLANTA
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What's Happening...

capacity of nearly 1.8 million gallons and brings the total number of tanks at the Boise terminal to eight, with a total capacity of 8.5 million gallons.

Woods and Feasel Head Changes at Deep Rock Oil

Woods Feasel

Thell C. Woods, formerly process superintendent of Deep Rock Oil Corporation's Cushing, Okla., refinery, has been promoted to assistant to the vice president.

Raymond Feasel, formerly fuels manufacturer supervisor, will become process superintendent, replacing Woods.

In other changes, Quentin E. Benedict was promoted from lubricants manufacturing supervisor to assistant process superintendent, and Thomas Coleman Jones, formerly shift supervisor, has been promoted to cracking plant foreman.

Lummus Adds Johnson To Staff as Associate

Dr. Raymond C. Johnson has been appointed an associate on the technical staff of Lummus Company, New York designing, engineering and constructors for the petroleum and chemical industries.

Johnson

Dr. Johnson will have as his primary responsibility the development, coordination and supervision of all activities involving the company's laboratories. He was formerly vice president in charge of research for the Anthracite Institute and prior to that was with the U. S. Bureau of Mines.

Humble Promotes Dedman

S. W. Dedman, Jr., has been promoted to senior mechanical engineer in the Engineering division of Humble Oil & Refining Company's Baytown, Texas, refinery. He has been with Humble since 1947. In his new position he will continue engineering assignments on various units at the Baytown refinery.

Little Adds Biochemist

Dr. Charles J. Kensler, well-known pharmacologist and biochemist, has joined the staff of Arthur D. Little, Inc. He will organize and expand the Biology department to offer increased

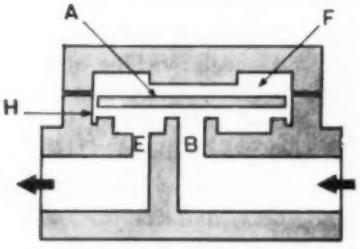
SARCO
Thermodynamic
STEAM TRAP

ACTUAL SIZE

this new trap virtually eliminates maintenance

SOLID STAINLESS STEEL DISC ACTS AS VALVE HEAD

HERE'S HOW IT WORKS!



Air and/or condensate raise valve seat disc A, discharge thru E. When steam follows, greater velocity causes it to strike body at H thus building up pressure in chamber F. This causes disc to seat, closing tube B. As pressure in F decreases by condensation, pressure in tube B raises disc and cycle is repeated.

The Sarco Thermodynamic Trap has proved successful on steam mains and separators; headers and soot blower pipes; engine and turbine stop valves, separators and casing drains; alternate heating and cooling applications.

2098-B

A solid stainless steel disc—practically indestructible—is the only moving part!

MOST striking feature of the Sarco *Thermodynamic* Trap is its simple maintenance-free design. There's only one moving part – a solid stainless steel disc that practically lasts forever. There are no other moving parts to wear out or cause trouble.

Condensate, air and steam act directly on the disc valve which opens to discharge condensate and air – snaps shut to contain steam. There are no mechanical devices required to operate valve (see diagram at left). That means practically endless trouble-free operation.

Other advantages: small size, easy installation, not affected by shock or vibration, immunity to corrosive elements with all wearing parts stainless steel, same valve head and seat for all pressures to 600 psi and temperatures to 950° F.

Check these advantages to your own satisfaction at absolutely no cost. We'll send you a trap for trial. All you do is fill out the coupon and mail it in.

SARCO COMPANY, Inc.
Empire State Building, New York 1, N.Y.

MAIL COUPON TODAY FOR TRIAL

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y.
Gentlemen: Please send me a Sarco Thermodynamic Trap for a 60-day trial, requirements as checked.
Size: ½"... ¾"... 1"... Operating Pressure:.....psi

For installation on.....

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

What's Happening. . .

research services in the fields of pharmacology, biochemistry, toxicology, enzymology, nutrition, and industrial hygiene.

Hussey of Esso Standard Assigned to Abadan Post

Daniel L. Hussey, who has been general superintendent of the Bayway, N. J., refinery of Esso Standard Oil Company since January, 1953, has accepted a loan assignment as head of the Refinery Survey Party at the Abadan refinery in Iran. Hussey began his new assignment last month.

Succeeding Hussey as general superintendent of the Bayway refinery is G. R. Murrell, head of the Petroleum Products division of the company's Baton Rouge, La., refinery.

Bemis Winds Up 43 Years At Standard of Indiana

H. J. Bemis, manager of the Gasoline and Refined Oils department of Standard Oil Company (Indiana), has retired on annuity after more than 43 years of service. H. K. Apel, assistant manager of the department, has been promoted to succeed him as manager.

Bemis joined the company in 1911 at Chicago, became manager of the Gasoline and Refined Oils department in 1943. Apel joined the company in 1914 as a clerk and stenographer.

Process Handbook Reprint

Complete with 69 process descriptions and 69 flow diagrams. Also with the Maples' article on "Gasoline Blending Stocks."

Address orders to Reprint Department, Petroleum REFINER, P. O. Box 2608, Houston, Texas. $1 per copy.

Standard Oil Development Makes Esso Lab Changes

Changes in assignments within its Esso Laboratories have been announced by Standard Oil Development Company.

Homer Z. Martin, presently assistant director of the Development division, is being transferred to the Research division as assistant director for one year on a rotational assignment. During this period of assignment, Arnold F. Kaulakis and Henry J. Ogorzaly will in turn assume Dr. Martin's responsibilities in the Development division. Both Kaulakis and Ogorzaly are members of the Development division.

Carnegie's Rossini Will Head New Research Project

A long-range research project has been jointly announced by Carnegie Institute of Technology, Pittsburgh, and the Manufacturing Chemists Association, headquartered in Washington, D. C.

Rossini

Basically, the purpose of the project is to provide readily accessible uniform data on the physical properties of chemical compounds. The chemical compounds to be covered in the investigation will start with those having the greatest tonnage and value in production and gradually will be increased to include all of the simpler inorganic and organic compounds.

The work will be directed by Dr. Frederick D. Rossini, head of the Department of Chemistry at Carnegie, who is recognized internationally for his similar direction of a fundamental research in petroleum.

The new program for the chemical industry will be patterned after the highly successful American Petroleum Institute's Research Project 44 on "Data on Hydrocarbons and Related Compounds," which also is directed on the Tech campus by Dr. Rossini. Funds for the new project will be contributed by the chemical industry, and an esti-

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FOR YOUR *Product*

FOR YOUR *Budget*

What's your product . . . gasoline, butane, anhydrous ammonia? No matter what it is, Lubbock Machine and Supply Company can manufacture a transport tank that's engineered for your product and priced for your budget. Your transport tank from Lubbock Machine and Supply will carry the maximum pay load for your state, fit your individual trucks, and conform to state highway and ICC regulations. Write today for information regarding prices, pay loads, our easy budget plan, etc.

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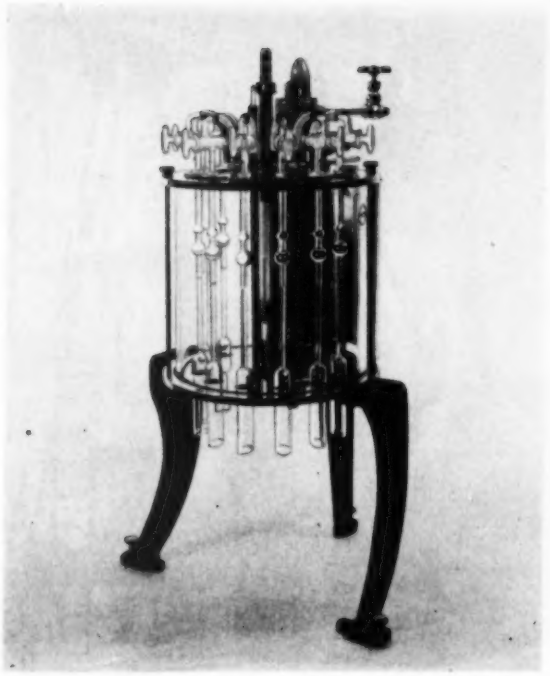


ATLANTIC VISCOMETERS *by* KONTES

Available Commercially *For The First Time!*

THE Atlantic Viscometer was developed in the Atlantic Refining Company Product Control Department Laboratories. During its various stages of development over the past 15 years, it has been in constant daily service. It has proven easy to manipulate and sturdy enough to reduce breakage to a very low figure.

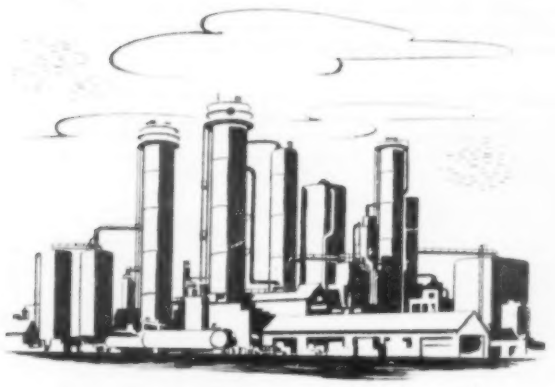
The Atlantic Viscometer meets the need for a durable routine capillary type viscometer of the suspended level type. It has, therefore, no surface tension correction and a constant value of viscometer C—constant over a wide range of temperature.

Outstanding design features are:

- **Ease of Manipulation**
- **Rugged Construction**
- **Eliminates time-consuming handling**
- **Precision**

The Atlantic Viscometer is permanently mounted in the viscometer bath. Handling, the cause for most breakage, is reduced. Many successful comparisons with oils measured in long capillary viscometers have attested the precision of the Atlantic Viscometer. It has found acceptance by the American Society for Testing Materials and is listed as one of the approved methods by ASTM Committee D-2 under Method D445-53T.

The Atlantic Viscometer is described in an article by J. J. Watt and C. E. Headington, which appears on page 137 of this issue.



KONTES GLASS COMPANY
VINELAND, NEW JERSEY

We'll be pleased to supply you with further information and prices on the Atlantic Viscometer. If your production or research involves other applications of glass, however intricate, we invite your inquiries. Write for our complete catalog.

For more data on advertised products, use Readers' Service Cards, last page.

Wagner 15 hp splash-proof motor on a Magnolia Petroleum Company unit pumper in Lea County, New Mexico.

This Wagner 15 hp Type XP high torque splash-proof motor operates a unit pumper in Magnolia's Mankins No. 1 field, Shamrock, Texas.

Wagner MOTORS

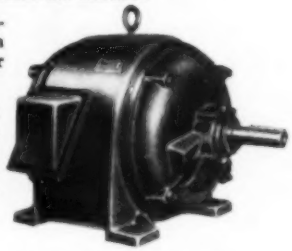
your best choice

FOR OIL WELL PUMPING

Wagner Motors for oil well pumping are the standard choice of many leaders in the petroleum industry because these motors are especially engineered to do the job expected of them. They will operate continually—without attention—while exposed to all kinds of weather.

The line includes 40° C drip-proof motors that combine the desirable characteristics of open motors with protection that assures long outdoor life; splash-proof motors that offer additional protection if desired; and high power factor type capacitor motors, with the same enclosures, for use where single-phase motors are needed.

Wagner also furnishes totally-enclosed fan-cooled motors in standard or explosion proof types for use in pumping stations or refineries.



Bulletin MU-137 on Oil Well Pumping Motors and Bulletin MU-132 on Cast Iron Frame Motors give complete information. Thirty-two branch offices are ready to assist you in any motor application problem.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6458 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE
BRAKE SYSTEMS—
AIR AND HYDRAULIC

M56-19

For more data on advertised products, use Readers' Service Cards, last page.

What's Happening. . .

mated $40,000 required for the first year of operation has already been subscribed.

Southern Production Moves Dorsey to New Assignment

Leon B. Dorsey, former plant superintendent at the Pledger gasoline plant of Southern Production Company, Inc., near West Columbia, Texas, has been transferred to the company's general offices at Fort Worth.

Dorsey

With the transfer, Dorsey received the appointment of superintendent of gasoline plants, and was assigned the duties of coordinating all gasoline plant activities for the company.

M. V. Dunk, assistant plant superintendent, will take over the duties of superintendent at Pledger.

UGCCW Delegates Vote To Merge With OWIU

On a roll call vote of 667 to 192, prodded delegates to the United Gas, Coke and Chemical Workers convention in St. Louis last month approved merger of their union with the Oil Workers International Union.

The approval vote came after the rebellious delegates refused to make it unanimous and after CIO President Walter Reuther had given them the ultimatum to merge or go their own way, without CIO financial support. Reuther told the delegates bluntly that neither union was strong enough to organize more than the fringe of their industries but that, together and backed by the CIO's exchequer and organizers, they could become one of the most powerful in the nation.

Tide Water Maps Plans For Pay in Closing Plant

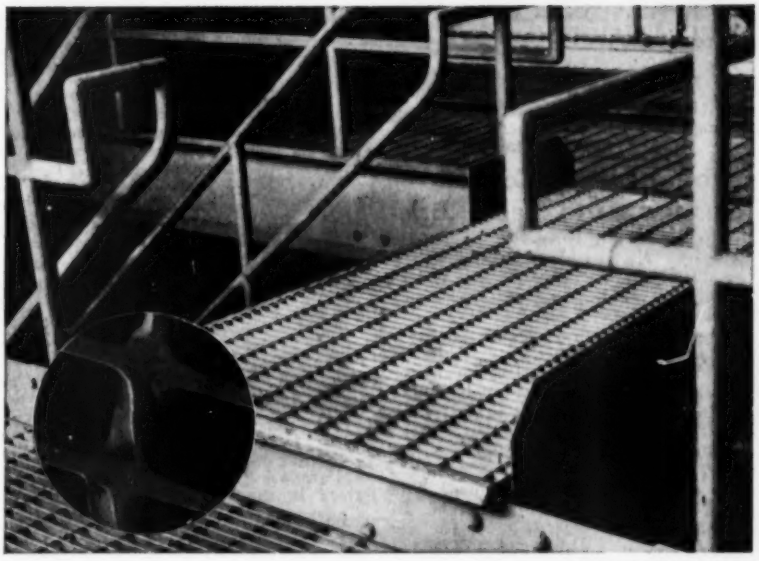
Employes at the Bayonne, N. J., refinery of Tide Water Associated Oil Company will receive a separation allowance based on weekly pay and years of service when their jobs are terminated when the company closes down the plant.

Tide Water is closing the Bayonne plant because it is "obsolete" and because it would not be "economically justifiable to attempt to rehabilitate it."

The company is now moving forward on plans to build a new and larger refinery elsewhere on the Eastern Seaboard.

ARF Promotes Cousins

William M. Cousins, Jr., has been promoted to assistant director in charge of business operations at Armour Research Foundation of Illinois Institute of Technology, Chicago. In his new position, Cousins, who formerly was business



Grating by BLAW-KNOX

where do you need
steel grating?

There must be lots of places where you are now using grating—floors, platforms, walkways, catwalks and stair treads, for example.

But how about other uses—such as some sturdy shelving or a fan guard—or for covering a dangerous open pit or a light well. Take a good look around your plant and you'll probably come up with several jobs, including perhaps a new use, as steel grating is adaptable to many applications.

Any time you want some help on a job related to grating, we'll be glad to hear from you.

Only BLAW-KNOX Electroforged® Steel Grating and Stair Treads —have these five exclusive features:

1. rigid one-piece construction—easy to install
2. all surfaces accessible—easy to paint
3. no sharp corners to clog—self-cleaning
4. maximum open area—for light and ventilation
5. non-slip twisted crossbar—safe footing

A short note will bring you a copy of new Bulletin No. 2365-R —a dimensional sketch will bring you a quotation.

BLAW-KNOX

BLAW-KNOX COMPANY
2005 Farmers Bank Building • Pittsburgh 22, Pennsylvania

BLAW-KNOX EQUIPMENT DIVISION
GRATING DEPARTMENT

GRATING APPLICATIONS: floors • platforms • walkways • catwalks • stair treads • fan guards • shelving • and many other uses, both outdoors and indoors, for versatile steel grating.

For more data on advertised products, use Readers' Service Cards, last page.

What's Happening. . .

manager, will continue to be responsible for ARF's financial, contractual, service, and magnetic recording operations.

National Safety Council Gives Award to Deep Rock

Deep Rock Oil Corporation has received the National Safety Council's Award of Merit for the 1953 safety performance of its Refining and Pipeline departments.

Only 27 other companies in the U. S. qualified for a similar award, while 25 qualified for the council's Award of Honor. These are the two highest awards given to industrial firms in the field of plant safety.

Deep Rock's Refining division has now accumulated a total of 850,000 manhours without a disabling accident. The record goes back to June 1, 1953. In addition to the award certificate, the Deep Rock Tulsa refinery is authorized to fly the National Safety Council flag for the 1953 achievement.

Tide Water Names Two

In appointments at the Bayonne, N. J., refinery of Tide Water Associated Oil Company, Robert C. Harms has been named to acting mechanical superintendent, and Everett T. Chandler to machine shop foreman.

Harms was formerly zone supervisor, Chandler formerly assistant general foreman of the machine shop.

Harmon Succeeds Parsons as Pure Oil Purchasing Agent

John H. Harmon, Jr., formerly assistant general purchasing agent for The Pure Oil Company, has become general purchasing agent. He succeeds G. L. Parsons, who, after 30 years in the post, has become purchasing agent emeritus.

Harmon

Harmon joined Pure as an open order clerk in 1934. Since then he has worked in several divisions as junior engineer, industrial oil salesman, assistant chief clerk, buyer and assistant general purchasing agent.

Parsons' first Pure Oil job was as a clerk in the Producing division in Charleston, W. Va.

Refiners Elect Brown

Harry A. Brown, vice president of Frontier Refining Company, was elected chairman of the Rocky Mountain Oil & Gas Association Refining Committee at the group's annual meeting held last month at Casper, Wyo. Phil Kretz, The Texas Company, was elected vice chairman.

More than 75 members of the organization participated in a discussion of industrial relations, labor laws and technical advancement in refining.

Chemicals Wanted

The National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Federal and Dearborn Streets, Chicago 16, has received urgent requests for the chemicals listed below. If anyone has one or more, even if only one gram quantities, please inform the Registry.

Thiobenzamide
Truxillic acid
1,2,3-Butanetriol
p-Phenylphenyl bromide
3,3,3-Trichloropropylene
Methylphenyl sulfide
Octene-3
Tri(p-nitrophenyl) carbinol
2,4-Dichlorobenzyl alcohol
3-Methyl-1,6-hexanediol
3-Methyl-2-naphthoic acid
4-Methyl-1,4-heptanediol
alpha-Chloro-beta-naphthol
Methylethylphosphine
m-Aminodiphenyl
Methyltriborine triamine
Lauryl dimethylamine
alpha-Bromoacrylonitrile
Isohexyl heptyl-beta-naphthol
Isolaurylamine

Olin Mathieson Chemical Elects Slate of Officers

The following officers have been elected at Olin Mathieson Chemical Corporation, formed recently by the merger of Olin Industries, Inc., and Mathieson Chemical Corporation:

John W. Hanes, chairman of the finance committee and vice president for finance; F. Stillman Elfred, John C. Leppart, Stanley de J. Osborne, executive vice presidents.

Russell R. Casteel, vice president; Norman H. Collisson, vice president for operations; Donald N. Drummond, vice president for operations; R. L. Hockley, vice president for operations; Russell Hopkinson, vice president for development; Robert W. Lea, vice president for organization; R. B. Lewis, vice president for financial analysis; David T. Marvel, vice president for sales; Milton F. Meissner, vice president for operations; S. L. Nevins, vice president for operations; Walter F. O'Connell, vice president and assistant to the vice president for finance; Fred Olsen, vice president for research; Ralph A. Ostberg, vice president for production; J. J. Toohy, vice president for operations; Theodore Weicker, Jr., vice president for overseas operations; Edgar W. Taft, treasurer; C. C. Tallman, comptroller; Gordon Grand, Jr., secretary; E. R. Van Vliet, assistant treasurer; A. P. Winsor, assistant secretary.

John M. Olin is chairman of the board and Thomas S. Nichols is president.

All of the newly elected officers were formerly associated with one or the other of the predecessor companies.

Premier Consolidating

The East Texas refining operations of Premier Oil Refining Company of Texas at Longview are being consoli-

KOEHLER "ATLANTIC-TYPE" KINEMATIC VISCOMETER

Developed in the Product Control Laboratories of the Atlantic Refining Co.

A revolutionary improvement in viscosity testing, featuring a bath with precise temperature control and permanent vertical alignment (two-point mounting) of viscometers—now available to the Petroleum Industry for the first time.

Outstanding Features

- ★ 8-Tube Capacity
- ★ Temperature Control of better than ±0.02° F.
- ★ Ideally Suited for Plant Control or Routine Lab. Testing
- ★ Permanent Tube Installation, assuring perfect vertical alignment and low breakage
- ★ Circular Design to eliminate dead spots
- ★ Rugged Construction
- ★ Interior Illumination for perfect visibility
- ★ Ease of Manipulation and Operation
- ★ Elimination of time-consuming handling for cleaning and filling
- ★ Elimination of need for separate cleaning apparatus
- ★ Maximum Safety—no electric motors

KOEHLER INSTRUMENT COMPANY, INC.

Manufacturers of Laboratory Instruments for the Petroleum Industry

168-56 DOUGLAS AVE. JAMAICA 33, N. Y.

dated. The move, according to the company, will result in greater operating efficiency and will involve increasing the amount of crude run at the Longview refinery and subsequent closing of the Arp refinery.

Powell Heads Department At California Standard

Powell

Miller

Fred Powell has been named general manager of the Manufacturing department in the western operations of Standard Oil Company of California. He was formerly president of California Research & Development Corporation, a Standard subsidiary which was dissolved earlier this year upon completion of its contracts with the Atomic Energy Commission. In the interim, Powell has been serving as assistant manager of Manufacturing, with supervision over chemical production.

Powell succeeds O. N. Miller, now a vice president of the company.

Standard Oil Foundation Sets Up Scholarship Plan

Standard Oil Foundation, Inc., has announced it will sponsor 16 scholarships and 22 fellowships in science and engineering during the school year beginning this semester.

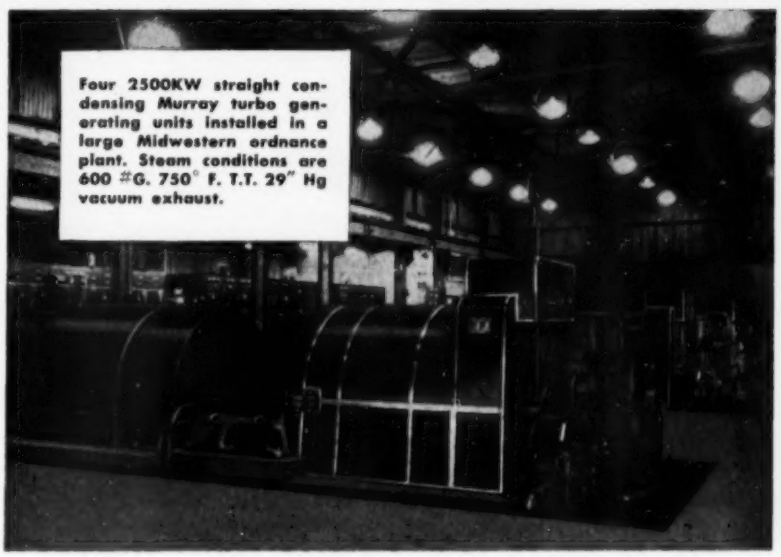
Dr. Robert E. Wilson, the foundation's chairman, said the scholarships go to outstanding chemistry students in 16 Midwest liberal art colleges which have exceptional records in training students for graduate work in this field. Each scholarship college receives $1000 for a school year, half to improve its chemistry department's facilities and half to help the student. Payments for fellows range from $2200 to $2500, depending on how near the student is to his doctorate.

Armistead Company to Help On Greek Refinery Project

First members of a consulting engineering group have departed for Greece in connection with plans for the construction of a 30,000-barrel-a-day refinery in that country. They are employes of George Armistead and Company, Washington, D. C., which has been appointed consulting engineers by the Greek government to assist and advise it on the project. Invitations for proposals for the construction of the refinery have been issued to interested parties by the Greek government.

Reports from Athens say that four bids have been received by the Greek

Murray Turbines



Four 2500KW straight condensing Murray turbo generating units installed in a large Midwestern ordnance plant. Steam conditions are 600 #G. 750° F. T.T. 29" Hg vacuum exhaust.

● Murray Turbo Generator units can be furnished to meet your special requirements in sizes up to 3000KW. Condensing and non-condensing types with or without extraction and/or mixed pressure features can be furnished. Whether you require a small inexpensive standby unit or a highly efficient, and reliable source of power, Murray has a design to fit your needs. Consult your local Murray representative who will gladly help you select the unit most economically suited to your conditions.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

For more data on advertised products, use Readers' Service Cards, last page.

Meet the man you can call with confidence to solve your thermal insulation problems

To insulate outdoor tanks with complete weather protection, these skilled J-M applicators follow a specification developed by Johns-Manville. Here they are fastening J-M Asbestocite* Sheets over J-M Zerolite* Insulation. J-M 85% Magnesia Insulation is also widely used for this type of equipment

He is your J-M Insulation Contractor... the man with the world's most complete insulation engineering service

"Insulation is no better than the man who applies it." Today, with rising fuel and maintenance costs, it is especially important to place your insulation job in skilled hands. The scientific application of J-M quality insulations by J-M Insulation Contractors will assure you of the maximum return on your insulation investment for years to come. Moreover, you get undivided responsibility for *all* your insulation requirements.

1. You get dependable materials—Johns-Manville manufactures a complete line of insulations for every service temperature from minus 400F to plus 3000F. From them your J-M Insulation Contractor can select the right insulation for the most dependable service on your job. To develop new and improved insulation materials Johns-Manville maintains the J-M Research Center—largest laboratory of its kind in the world.

2. You get dependable engineering—For 95 years Johns-Manville has been accumulating insulation engineering experience. J-M Insulation Engineers are called upon to solve insulation problems of every type and magnitude, in every industry. Since your J-M Insulation Contractor works closely with J-M Insulation Engineers, he brings to *every* job a high degree of training, skill and experience.

3. You get dependable application—Johns-Manville has set up a nationwide organization of J-M Insulation Contractors to serve you. These Contractors maintain staffs of insulation engineers as well as skilled mechanics thoroughly trained in J-M's proved application methods. You can have absolute confidence in their ability to apply J-M insulations correctly for trouble-free performance.

For further information and the name of your J-M Insulation Contractor, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.

*Reg. U. S. Pat. Off.

Johns-Manville *FIRST IN* INSULATION

MATERIALS · ENGINEERING · APPLICATION

What's Happening. . .

government. No details were disclosed, but bidders have been unofficially identified as Socony-Vacuum Oil Company, Spyros Skouras' Greek-American group, and two German firms.

Mroz Sets Up Office As Consulting Engineer

Edmund A. J. Mroz has established a chemical engineering consulting service for small and medium sized New England industries. He was formerly a member of the Process Engineering department of Stone & Webster Engineering Corporation and the Badger Process division. He joined the former E. B. Badger & Sons Company at the end of World War II.

Mroz

Morz has participated in the startup of many oil refinery and chemical plant installations in the U. S., Canada, France and Kuwait.

Texaco Veteran Retires

Richard L. Saunders, vice president and director of The Texas Company, has retired after 45 years with the company. One of the oldest employes from the standpoint of continuous service, Saunders joined Texaco in 1909 as a voucher clerk in the New York office. He was appointed vice president in charge of domestic sales in 1945 and elected a director in 1946.

Morrison Succeeds Smith

Carl G. Morrison, of Baton Rouge, La., on loan from Enjay Company, has been sworn in as director of the Chemicals and Rubber Division of Business and Defense Services Administration.

He will serve the government for six months without compensation under a rotation system. He succeeds Harold H. Smith, who has returned to The Dow Chemical Company after serving since March.

Former Sun Man Dies

Maximilian H. Leister, retired general manager of Sun Oil Company's Motor Products department, died September 19. He was 63.

Leister began his business career with Katz Advertising Agency in Philadelphia. He joined Sun Oil Company as a special assistant in the Motor Oil department in 1921.

Jersey Standard Man Dies

Roger H. Sherman, coordinator of producing activities for Standard Oil Company (New Jersey) and a director of both Standard Oil Development Company and Arabian American Oil Company, died September 5 at Forest Hills, N. Y. Sherman, 50, had been ill for some time.

Why send 8 boys to do 1 man's job?

INSTALL **CAL-FIN** TANK HEATERS

ONE foot of CAL-FIN TANK HEATER tubing has more heating surface and with viscous oils does more work than EIGHT feet of bare pipe of the same size. This means REAL SAVINGS in first cost. The low over-all height permits the fluid level of the tank to be run down as low as 36 inches and still have the heater completely submerged.

For detailed information, write for Bulletin #3005

drayer-hanson
INCORPORATED
LOS ANGELES 1, CALIFORNIA

CAL-FIN Tank Heaters are available in standard sizes up to 1,325 sq. ft., and special sizes up to 6,000 sq. ft.

For more data on advertised products, use Readers' Service Cards, last page.

TRANSAIRE® Pressure Transmitter solves these tough problems!

Measuring within ½% of 20-40 psi shiftable range spans

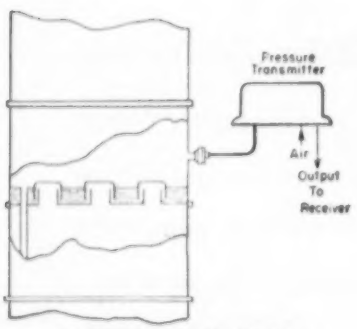
THE Taylor TRANSAIRE Pressure Transmitter with short, shiftable spans gives unprecedented accuracy and sensitivity—plus the convenience of suppressed ranges at high pressure levels. Operating on the simple force-balance principle, it will measure and transmit minute pressure changes up to 1,000 ft. It's accurate to ½% of the selected short range span and sensitive to pressure changes of ½" water.

THREE IMPORTANT ADVANTAGES

1. Range spans of 20 and 40 psi are available throughout the range limits of 35 to 415 psia; 50 to 100 psi throughout 100 to 1,000 psia.

2. The volumetric type pressure system is extremely accurate, practically clog-proof, has a corrosion-resistant 316 stainless steel diaphragm.

3. Temperature and barometric compensation make for higher accuracy of measurement, and consequently closer control.



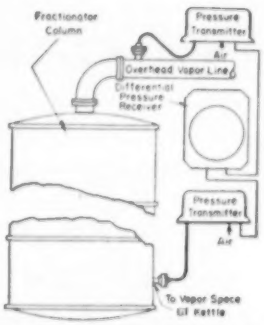
COLUMN PRESSURE

NARROW RANGE SPAN DETECTS PRESSURE TRENDS

Problem: To get highest possible purity of product consistent with good production economy. This requires the quick detection of pressure trends over a very narrow range.

Solution: The short, shiftable range spans (as short as 20 psi) of the TRANSAIRE Pressure Transmitter permit selection of operating range by a simple screw-driver adjustment. Its high order of sensitivity enables the operator to detect minute changes of pressure.

Result: Close control, because the minute pressure trends are practically instantaneously detected and transmitted to the controller and receiver. This means higher yield of a purer product, also great flexibility in changing to different product requirements.



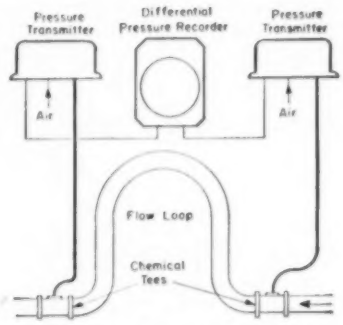
COLUMN PRESSURE DROP

PERMITS MAXIMUM CAPACITY OPERATION

Problem: To operate a column at maximum capacity, consistent with the preventing of flooding.

Solution: As the pressure drop across the column is a measure of the vapor velocity, the measurement of this drop with a short-range, highly sensitive, easily adjustable instrument enables the operator to keep the column safely close to the flooding point.

Result: Maximum production and uniform operation.



FLOW OF VISCOUS LIQUORS

STREAMLINED SURFACE PREVENTS SCALE, SOLIDIFICATION

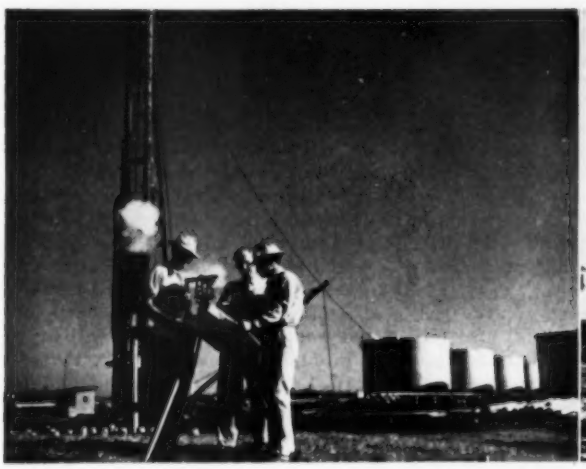
Problem: Flow measurement of viscous material which tends to solidify when static, making conventional differential producers impractical.

Solution: Its flush element presents a streamlined surface and tends to prevent formation of scale or solidification of liquors. Its short range, high sensitivity and volumetric construction makes the TRANSAIRE Pressure Transmitter ideal for this application.

Result: Trouble-free, accurate measurement and control of flow. One installation has given continuously satisfactory service for four years.

Ask your Taylor Field Engineer, or write for **Bulletin 98097.**
Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

Taylor Instruments MEAN ACCURACY FIRST



Operations stories showing how certain work is done help create better understanding and group pride.

The employe publication can be a training aid—provided the material is interestingly presented.

How to Start an Employe Publication

The author has told you how to determine whether you need an employe publication. Now he offers some money-saving advice on how to go about the job.

Homer T. Fort,
Magnolia Petroleum Company,
Dallas

IF YOU DECIDE that you need some kind of employe information piece, it is suggested that you proceed as follows:

1. Select an editor;
2. Write out the specific objectives of the publication;
3. Decide generally on the types of editorial matter to be published;
4. Estimate costs and decide on a budget;
5. Decide on design and frequency of publication;
6. Plan details of administration.

Steps 1, 4 and 6 you should handle yourself. Step 2 should be handled jointly with the editor you select. Steps 3 and 5 should have your approval but with the editor making the recommendations.

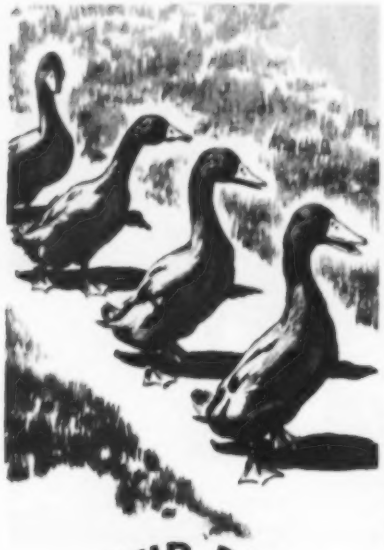
Selection of an editor, which might seem to come more logically down the list, is placed first simply because you need the advice of someone trained in publications to make later decisions. The question of newspaper or magazine format, for instance, should be settled only after the editor has had a chance to review the types of editorial matter he will publish. It is this that should govern selection of format, and not any vague statement of "we like a newspaper better" or "a magazine has more dignity."

Your choice of an editor is the most important ingredient in your publication's success. The best sources are, in order of preference:

- Persons with college journalism and experience in industrial editing;
- Persons with college journalism;
- Persons with experience in industrial editing (this could be on a par with the next above—but have someone evaluate the quality of their previous publications first);
- A present employe with high school or other journalism training.

It is a mistake to think that the editor's job is simple and that is easier to make an editor of an employe than to get a trained person who will "fit in." There are a few untrained editors who have turned out exceptionally good publications after the period of learning and trial-and-error is over, but not many.

Journalism is a technical subject dealing with psychology and in the mechanics by which knowledge of psychology can be used to inform and entertain. Approximately 32 percent of the persons belonging to the International Council of Industrial Editors majored in college journalism. This figure is growing. Many companies are realizing that, in getting a spokesman for management policy, they



SULPHUR-DIOXIDE
HIGHEST QUALITY
SO_2

May Put Your DUCKS IN A ROW!

Many industries with vision have lined up their problems with **Tennessee Corporation Sulphur-Dioxide.** In most cases a more advantageous and economical operation has been achieved through the use of this chemical (SO_2) with its extreme versatility. We can supply **Tennessee's** fine quality **Sulphur-Dioxide** in any desired quantities. Perhaps you have a specific process in which **Tennessee Sulphur-Dioxide** may increase your plant efficiency. Let our own technical experts advise you by writing for details.

CONTAINERS
- Cylinders
- Ton Drums
- Tank Trucks
- Tank Cars

Samples, Specifications and Detailed Information on Request.

TENNESSEE CORPORATION
617-620 Grant Building, Atlanta, Ga.

As Management Sees It . . .

should not take chances with inadequately prepared people.

A few colleges in the nation—there is at least one in the Southwest—have special courses in industrial editing as a part of their journalism curriculum. But any college with a good reputation in the journalism field offers a source.

Another possible check-point is the association of industrial editors in your area. It probably maintains a placement service.

Looking beyond his technical background, your editor should also pass the other standards you have for professional employes. One particular quality should be sought: ability to "make himself at home" in groups of both management people and wage-earners. Size him up for any qualities that would make his job of getting acceptance from your workers difficult. Remember also that he may be getting the inside story on many plant plans and problems; you won't want indiscreetness.

Working with your editor, you should *write out the specific objectives of the publication*. These can be changed later, if desired, but the editor needs a statement as to what the publication is expected to deal with. Management should name these or approve them. A publication which does not have before it a listing of the problems or areas in which it is to concentrate lacks direction. It should have more than one, but it should not have so many that it has to spread itself buckshot-fashion over too wide a field. Establishing objectives or priority items for concentration is the best guarantee that the publication will be kept on a straight editorial line.

A sample listing of such objectives might run like this:

- Better understanding of union contracts;
- Promotion of off-the-job safety;
- Recognize exceptional cases of individual initiative;
- Explain functions of staff departments;
- Answer any rumors reflecting on the company.

Such a list, incidentally, should not be a one-shot affair. It should be reviewed about once a year.

Once these objectives have been established, the *types of editorial matter to be published can be determined*. It will be possible, for instance, to decide what attention, if any, the publication should give to personal news about employes. A listing of any continuing columns or features can be made. Will quick news be the best way to present the material, or will it require somewhat longer treatment in articles? The editor can deal with that question as he sees the job before him. He will be looking ahead to methods of carrying out his objectives, balancing them with material intended strictly to gain readership through entertainment, throwing a sidewise glance at what would appeal to employes' wives, trying to pull together a publication that employes will like and want and management will see as a profitable investment.

Doing this is a tough assignment. In planning editorial treatment both before and after the first issue, the editor should have flexibility. His publication has no value to the company unless it is read. It's his job, the one for which he has been trained, to get it read. Guide him on policy then, but give him room for imagination.

Space Flexibility—It is particularly important that the editorial matter planned should not have to fall within any designated proportion. You can't, for example, specify that 25 percent must be given to this subject and 10 percent to another. You'll probably lose your editor if you try. Instead, plan to review how the publication has dealt with its objectives at the end of a year's time, then study all issues, not merely one or two.

Steps 4 and 5—*estimating costs and deciding on design and frequency of publication*—have to be done simultaneously. Study of the types of material to be published should point strongly toward either newspaper or magazine treatment. Some idea as to frequency of publication should also be in mind.

Where the preponderance of material will be quick, short and newsy, the newspaper format likely will prove best. Timeliness must be considered with such material, since stale news kills readership. A small tabloid-size newspaper with publication twice a month might be the choice.

On the other hand, if the material will be mostly of article length with timeliness less important, a magazine-type publication with monthly or bimonthly distribution might be more suited.

The editor's training should have a payoff when the time comes to go to collect printers' estimates. He will know that use of a large number of pictures—with the possibility of a limited budget and a long press run—

For more data on advertised products, use Readers' Service Cards, last page.

INCREASE throughput capacity
ELIMINATE costly liquid loss
IMPROVE overhead product quality
REDUCE harmful air pollution
with

YORKMESH DeMISTERS

CASE STUDY NO. 1003

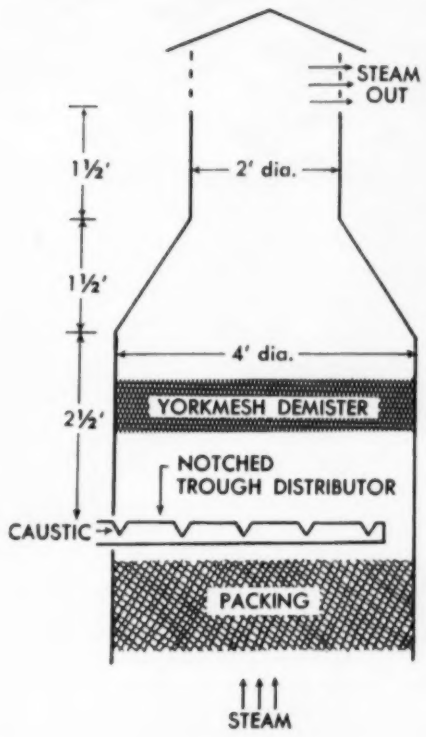
MONEL YORKMESH DeMISTER ELIMINATES CAUSTIC SPRAY

OBJECTIVE:
To eliminate an air pollution problem caused by a fine caustic spray from a scrubbing tower.

PROBLEM:
A four foot diameter tower employing caustic soda to scrub an organic material from steam gave rise to an objectionable finely divided caustic spray from the open top of the scrubber when operated at a steam rate of 3000#/hr.

SOLUTION:
A 6" thick monel Yorkmesh Demister was installed.

RESULTS:
The objectionable caustic spray on the surrounding area was eliminated entirely.



Note: for details and full description of installation write for case study No. 1003

YORK

OTTO H. YORK CO., INC.

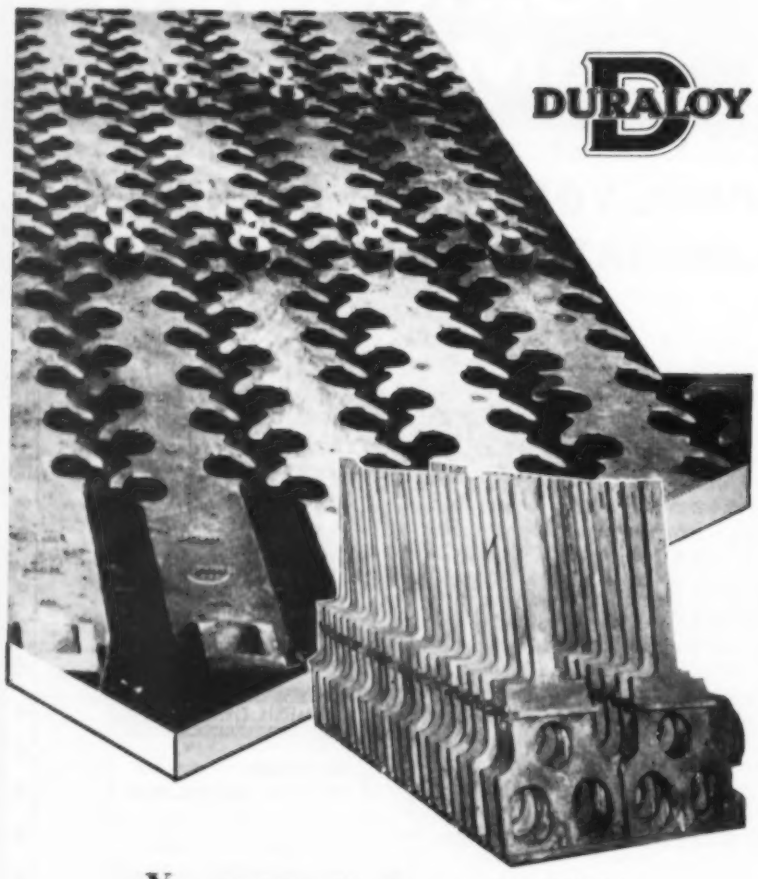
6 CENTRAL AVE. • WEST ORANGE, N. J.

For more data on advertised products, use Readers' Service Cards, last page.

CORROSION RESISTANT

HEAT RESISTANT

Tube Supports



You can't buy Better Tube Supports . . . DURALOY Tube Supports are alloyed to meet individual corrosion and heat requirements. They are alloyed by experienced metallurgists and melted and cast by experienced high-alloy foundrymen, both groups with experience going back some thirty years. Castings are carefully tested in our own laboratories which are completely equipped for metallurgical, chemical and physical testing.

Many refineries have been DURALOY customers for years. Many refineries insist upon DURALOY castings. Whether its straight production or engineering plus production, we are equipped to do the job. For more information, send for Bulletin No. 3150-G.

THE DURALOY COMPANY

Office and Plant Scottdale, Pa. • Eastern Office 12 East 41st Street, New York 17, N.Y.

METAL GOODS CORP. Dallas • Denver • Houston • Kansas City • New Orleans • St. Louis • Tulsa

As Management Sees It . . .

might dictate offset printing rather than letterpress. If it's a magazine, he will know how to get a dash of color on a few of his pages without buying it throughout.

He will also learn something about the printers' loads and their reputations for making deadlines and about the quality of their work. He also will realize that printers with the equipment to issue publications want to keep it busy and also like to have the assurance of the steady work that such a publication requires. He may be willing to set a standard per-issue price within which the editor can work without being charged for minor items.

To gain estimates on cost, the editor will have to present the printer with a fairly definite proposal on such things as size of page, number of pages, number of copies, use of color other than black, paper stock.

The cost estimates may then be studied and an idea of the over-all cost of the publication determined. Method of distribution should be taken into account. More than 60 percent of publications today are mailed direct to employe homes because it's a better way of catching the employe when he has leisure to look, and because his family will be interested (readership frequently runs as high as two non-employe readers for every worker). Mailing costs might thus be a factor.

If costs are too high, the editor can change his proposal in order to cut.

The publication at plant level has a tremendous advantage in its dealing with local situations—the same quality that makes weekly newspapers important on the American scene. The reader will put up with corner-cutting on costs if such must be done. On the other hand, costs should not be reduced to the point where the publication appears trashy or the editor can have no room in which to display his material.

You have, at this point, decided on what sort of publication you will issue. You know what it will cost, how often it will be issued, what sort of material it will publish to accomplish specified objectives.

Planning Administration—But before getting out the first issue, you should *plan details of its administration.*

To whom, for instance, will the editor be responsible? The editor will be interpreting management policy, so, in the thinking of some companies, he should report directly to the plant

For more data on advertised products, use Readers' Service Cards, last page.

Packaged Compressor Plant

Lowest Cost Per Horsepower Installed

Triples Production—

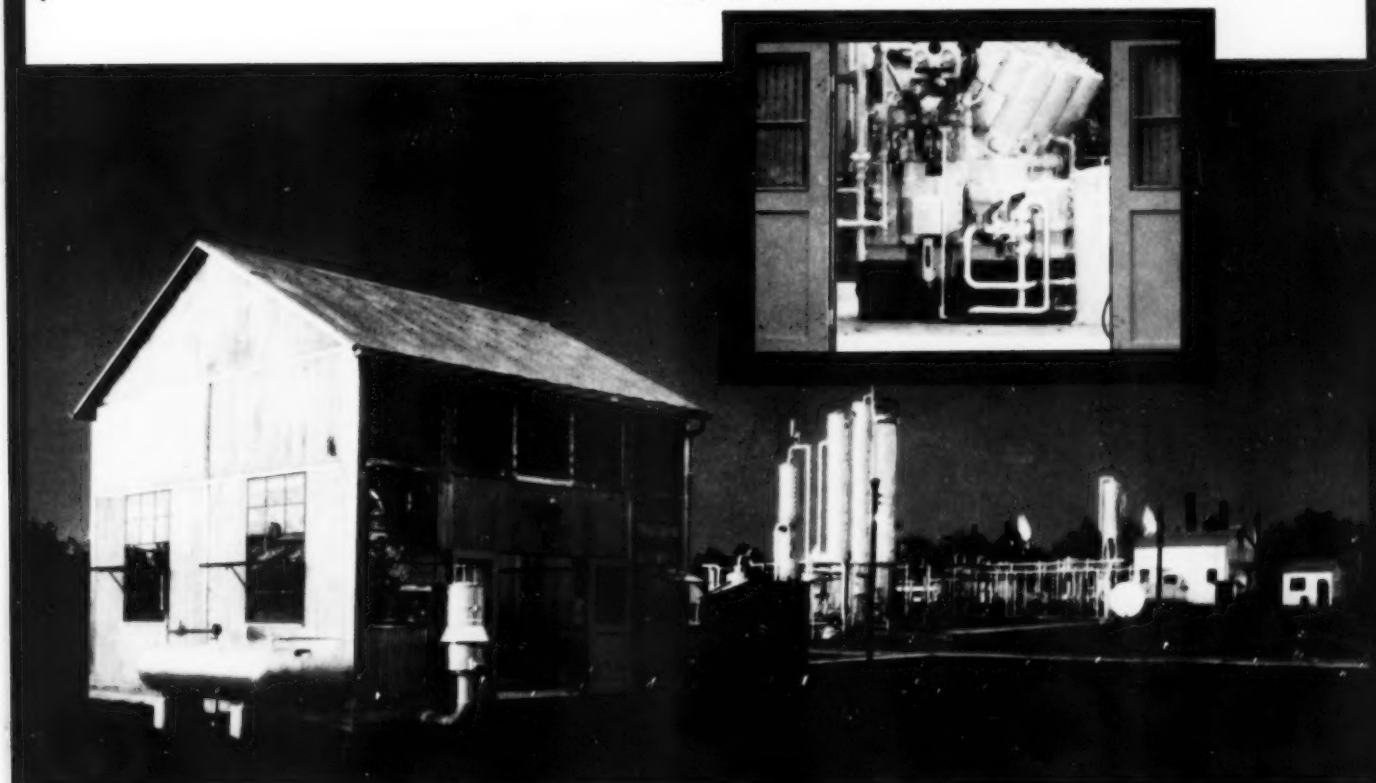
PACKAGED COMPRESSOR MAKES FLEXIBLE INSTALLATION

ARKANSAS LOUISIANA GAS COMPANY had seven wells in the Rodessa Field where wellhead pressures had dropped below the pressure of the gathering lines. Formerly good producers, the wells still contained profitable reserves that could be recovered by lowering gathering line pressure. To put the wells back into production economically, a 330 h.p. Beaird-Ingersoll-Rand Packaged Compressor Unit was installed at the Smithland, Texas, gasoline plant. Lowering pressure on the field line and boosting the gas through the plant and into the sales line, the unit tripled production from the wells.

Anticipating a relatively short life for the field, Arkansas Louisiana Gas specified that Beaird design the unit to meet a wide range of operating conditions. The flexibility of this design will permit the unit to be moved without change, to other service. Completely assembled and mounted on its own steel base it required a minimum in the way of permanent foundation and connecting piping. This feature makes the installation almost wholly salvageable when moved.

Pioneers and leaders in the development of packaged compressor plants — Beaird offers you proven equipment with an outstanding record of successful operation over a wide range of service.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your requirements.



Arkansas-Louisiana-Gas Company's Smithland, Texas, packaged compressor plant — equipped with an Ingersoll-Rand 330 h.p. 8SVG gas engine driven compressor, Young radiator and all necessary equipment and controls. Other sizes 110 h.p. to 660 h.p. The steel deck has been mounted flush with the flooring at the option of the purchaser.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana

BEAIRD

MACHINING MANUFACTURING STEEL WAREHOUSE

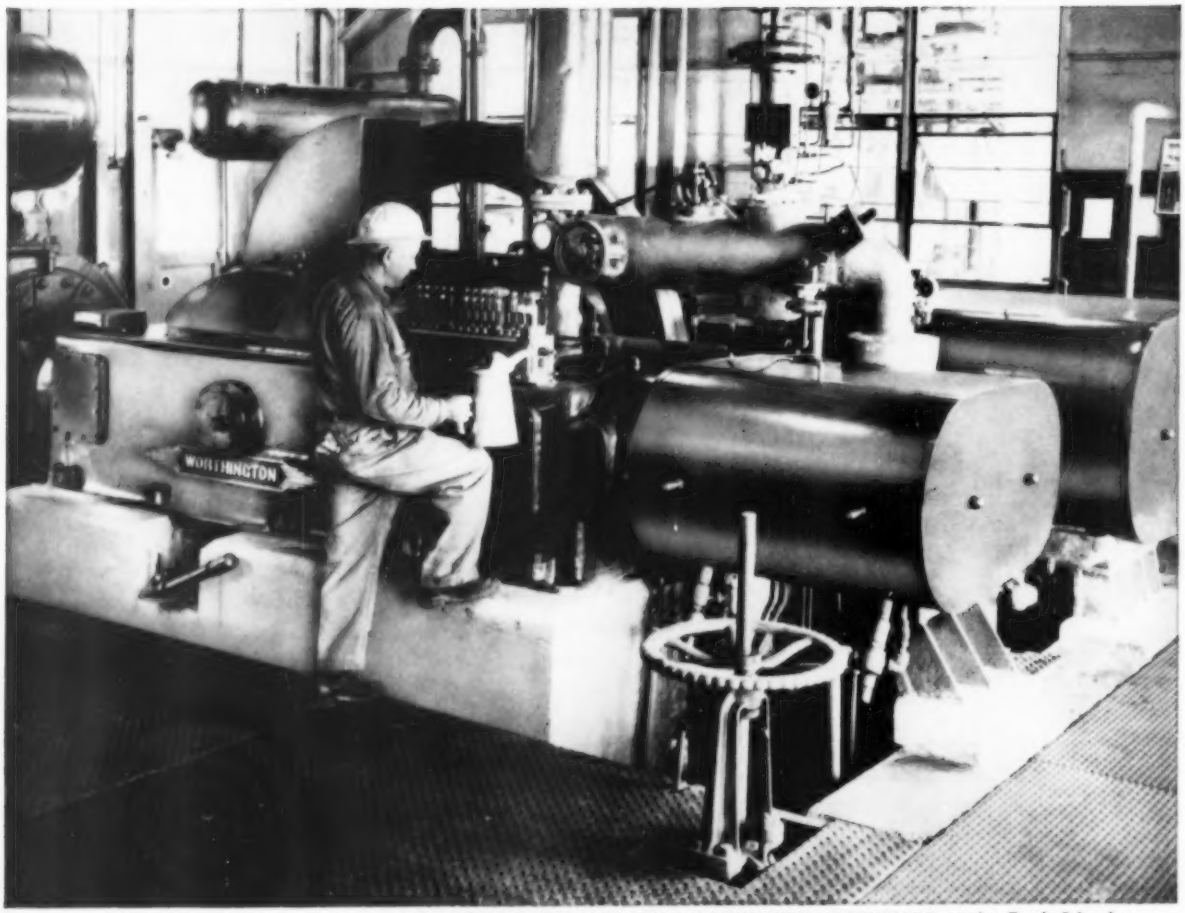
PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS



AVAILABLE STEAM DRIVES THIS WORTHINGTON COMPRESSOR at the Rock Island Refining Company in Indianapolis. Part of the hydrocarbon gas being compressed is taken off between compression stages and used to move a catalyst from storage.

Power failure won't stop this compressor

It's a Worthington *steam-driven* compressor which supplements a motor-driven compressor at the Rock Island Refining Company's plant in Indianapolis.

Here's the way Rock Island works it: the motor-driven machine (also a Worthington) is operated as a base load unit. The steam-driven compressor floats on the line, handling any swings in capacity by an increase or decrease in speed. And it's easy to vary the speed — and hence the capacity — by simply turning hand-wheels which control the amount of steam admitted to the compressor. If electrical power fails, the steam-driven unit can take over the entire compression job almost immediately. Result — process keeps going.

Five years of almost continuous operation have shown that the addition of the steam-driven Worthington was a wise move. One of the many features responsible for the fine performance record of this sturdy compressor is the exclusive Worthington Feather* Valve — the lightest, tightest, most efficient valve made. It's standard equipment on every Worthington compressor.

We'd like to help with your compressor problem, too. Write us. Worthington Corporation, Water Cooled Compressor Division, Section K.3.6, Buffalo, N.Y.

*Reg. U.S. Pat. Off.

K.3.6

WORTHINGTON

Only Worthington Compressors Give You Feather Valve Performance

Y-Types • Balanced Angle • Horizontal • Portable • Radial • Gas Engine Compressors

PALMER

presents

an outstanding improvement in

DIAL THERMOMETERS

external calibration

Full 3½" Dial Face

- **No Sector**
- **No Pinion**
- **No Linkage**
- **Constant Accuracy**
- **Easy Readability**

WRITE FOR BULLETIN 350

PALMER

THERMOMETERS, INC.

Norwood Ave., Cincinnati 12, Ohio

Mfrs. of Industrial Laboratory Recording and Dial Thermometers

manager. Others feel that the publication is an industrial relations arm and so should be under the head of that department. Others place him under a public relations department if such exists. Less often he is assigned under an advertising supervisor or an editorial board.

Whichever is chosen, it is important that the editor have access to management when he feels the need for discussing emphases and company policy.

A proper clearance procedure should be established in advance. A common trouble-causer is requiring the editor to clear material with so many persons that he has constant difficulty making deadlines. One suggestion is to clear material with the person supplying the bulk of the information, and with his department head. If the department head feels it is necessary, it can then be cleared with management. The editor's judgment, as it is developed by experience within the organization, can be relied upon after a period of time. But at first management or a designated department head may wish to read all material.

Whoever clears material should not try to substitute his judgment for that of the editor on any matters save those of accuracy and policy. Such things as location of material in the publication, method of display and writing style ought to be left to the editor whose training has been along those lines. The purpose of clearance is to keep the publication geared in closely with the total effort to better employe morale and promote the general interests of the plant and company. The editor should accept such clearance as necessary to the company and helpful to him. But don't make it so much of a chore that he must please a number of people down to the last comma.

Persons clearing publications material should clearly understand the need for speed. Publications can bog down quickly if material stays on desks too long or must await return of someone who hasn't named a substitute to act for him.

Also, be prepared from the outset to see factual mistakes in your publication. They happen in the biggest, most elaborate publications. Since such mistakes reflect on the editor, no matter who is at fault, he will do everything he can to keep them down. You can help by seeing to it that he has access to the people who know what the facts are.

With these things settled, you can

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for Casing and Tubing, Drill Collar and Tool Joint Threads

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- *anti-seize, prevents galling*
- *full makeup, easy breakout*
- *withstands high pressure & temperature*
- *perfect thread and shoulder contact*
- *will not pack or work harden*
- *perfect matrix for damming*
- *will not separate*
- *corrosion and rust inhibitor*

Contains pure metallic lead and copper flake.

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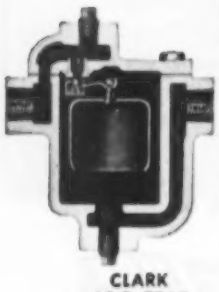
For more data on advertised products, use Readers' Service Cards, last page.

DOUBLE DRAINAGE

AT LOWER COST WITH

DUO-STEP Traps

FAMOUS DUO-STEP LEVERAGE IS NOW AVAILABLE FOR THE FIRST TIME ON THESE SMALLER SIZED STEAM TRAPS. GET HIGHEST DRAINAGE CAPACITY AT LOWEST COST.



CLARK 60-D TRAP

CLARK 70-D TRAP

Duo-Step is the revolutionary double fulcrum principle that affords maximum leverage to "crack" the valve from the orifice seat, teamed with "Follow-through" power that opens the orifice completely. This double action actually gives you double the drainage capacity of ordinary steam traps.

MODEL 60-D traps are of cast semi-steel construction, designed for pressures up to 200 P. S. I. and temperatures to 400°F. Duo-Step levers and brackets of stainless steel construction. Seats and discs are of Clark-loy. ½" or ¾" horizontal inlet and outlet connections with ¼" test outlet and drain plug. Vertical inlet can be furnished in ½" or ¾" size.

MODEL 70-D traps are of cast semi-steel construction, designed for pressures up to 200 P. S. I. and temperatures to 400°F. All working parts of stainless steel construction. Seats and discs are of Clark-loy. Horizontal inlet and outlet connections located at bottom of trap body for close-to-the-floor installations.

MODEL 70-TD for pressures to 150 P. S. I. and temperatures to 375°F. is available WITH BUILT-IN THERMAL BY-PASS at additional cost.

FOR COMPLETE INFORMATION CONTACT YOUR CLARK REPRESENTATIVE OR WRITE FOR *NEW* DUO-STEP BROCHURE

THE HOME OF DUO-STEP LEVERAGE

Clark

MANUFACTURING COMPANY

1830 EAST 38th STREET

CLEVELAND 14, OHIO

Distributors and Representatives in all major cities

As Management Sees It . . .

start your publication.

Periodically, your management should use it as a means of talking to employes. This doesn't necessarily mean a regular column, though that's often done. But signed, first-person articles by management give the magazine or paper prestige. Its recognition as a medium by which important messages can be sent is important to its readership.

Don't be afraid to use your publication as a means of presenting management's side on controversial matters. But make such presentations factual, accurate and void of personalities.

Recognize the editor's need for presenting material solely to entertain or build readership. Don't insist that every article be slanted directly toward an objective.

Your editor can help in a variety of ways aside from his publication—as a press contact man, in advising on visual aids, in speech preparation. But don't load him down with such assignments to the point where he cannot do a proper job on his primary task.

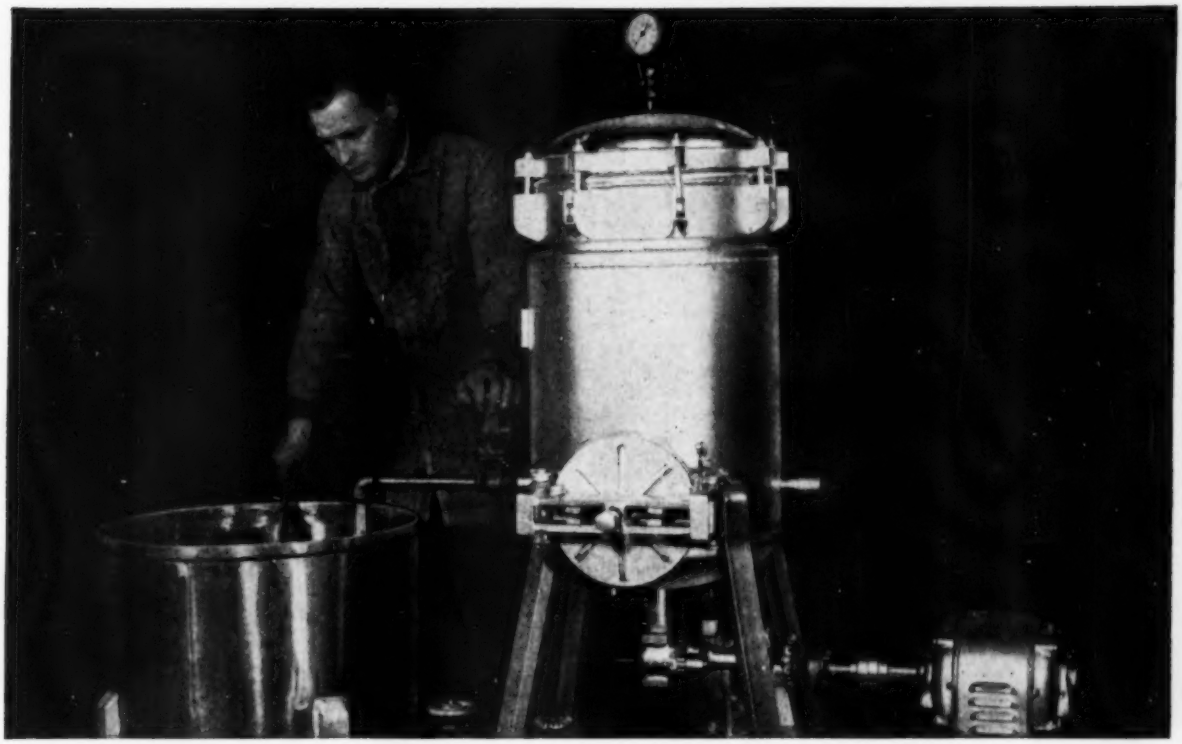
Be prepared to evaluate the publication once a year. Compare objectives with the total material published in promotion of each. See to it that the editor publishes a few direct appeals to employes during the year—appeals that will require definite action by employes and which can be watched. This could, for instance, cover a special bargain on safety shoes or requesting a free publication. Some idea of total effectiveness can be had from such response.

Check Readership—Get periodic checks on readership. The best and most expensive method is to call in outside consultants for personal interviews. If that's too much for the budget, try a postcard survey and cross-check it against interviews by other members of your staff with employes. Average response on a postcard survey is about 10 percent. You may be able to get it a bit higher.

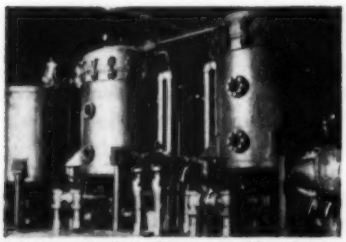
Don't be afraid to change your publication as weaknesses come to light or conditions shift. Keep it working for you, and don't let it drift into routine or become private property of the editor.

A publication doesn't have to be expensive—but it has to be good. It has to be read to be valuable, but pure readership isn't a mark of value if there's no payout to the company.

Done properly, it will have that payout. ##



Niagara Horizontal Filters provide rapid, easy dry cake removal . . . minimum down-time . . . complete filtrate clarity . . . and are available in sizes up to 1500 sq. ft. filtration area.



Niagara Vertical Filters provide highest liquid clarity. Compact, efficient, requiring minimum floor space. Sizes up to 960 sq. ft. filtration area.

Now you can

TRY BEFORE YOU BUY

your Niagara Filter

Do you have a filtration problem? Are you planning the use of filters in a new process? Are there variables and unknowns which make it impractical to theoretically predetermine filter size, leaf area, flow rate, etc.?

The sensible . . . and economical . . . approach is to *try before you buy*. And Niagara makes this easy for you by means of a practical pilot filter rental service.

Niagara pilot filters are accurate, small capacity scale model units constructed almost exactly like full size Niagara Pressure Leaf Filters. They do a thorough, efficient filtration job and enable you to observe and study results directly comparable to those you will get with production line Niagaras.

Niagara pilot filters, both vertical and horizontal type, are available for a nominal rental fee. A Niagara engineer will supervise the installation and will be glad to give you the benefit of his filtration experience if desired.

If you will fill out and mail the coupon below, we'll send you full details about the Niagara pilot filter rental service. Only a limited number of these pilot filters are available so we suggest prompt action.

Niagara Filters

DIVISION

AMERICAN MACHINE AND METALS, INC.

DEPT. PR1054, EAST MOLINE, ILLINOIS

In Europe: Niagara Filters Europe, Post Box 1109, Amsterdam-C, Holland

Please give us the details about your pilot filter rental service. Product to be filtered is _____

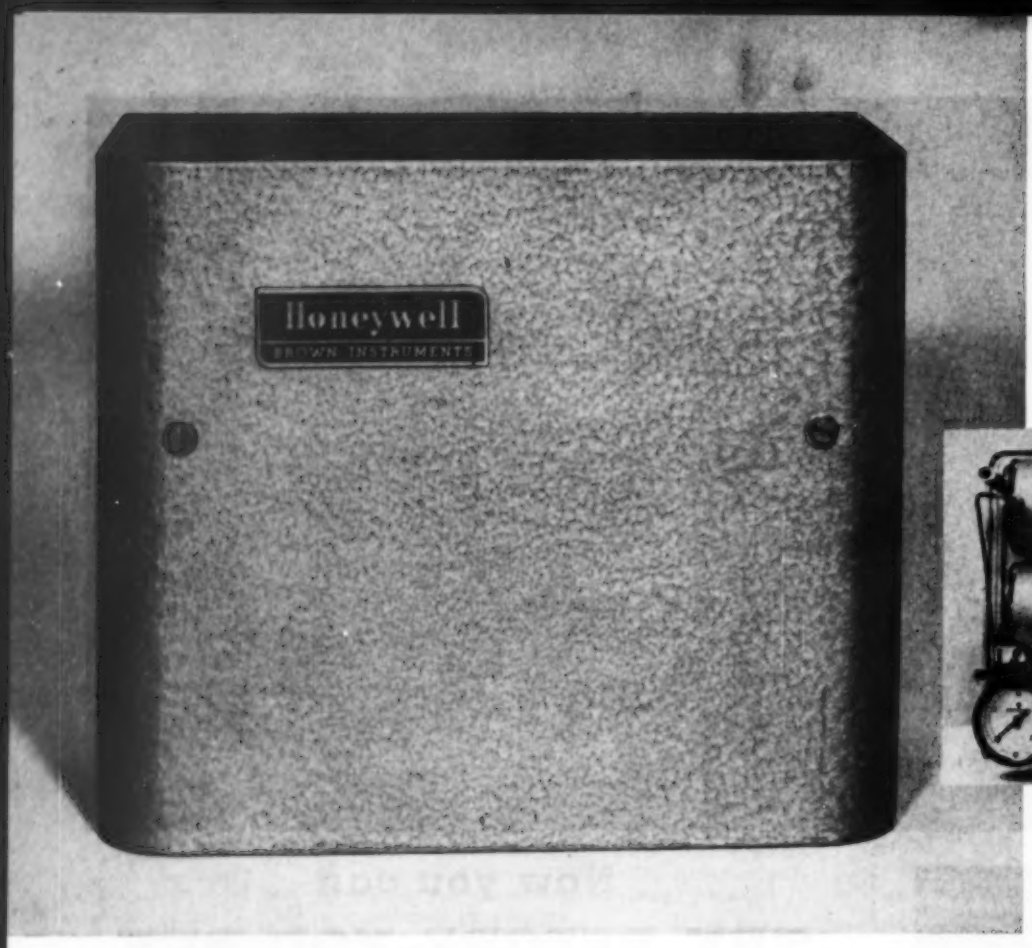
Name _____ Title _____

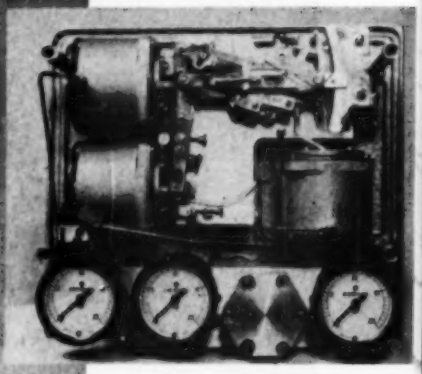
Company _____

Address _____

City _____ Zone ___ State _____

For more data on advertised products, use Readers' Service Cards, last page.





Interior view of Ratio Relay shows simple, compact construction. Pressure gages indicate input signals and output pressure. Adjustments for control action, zero setting and ratio range are readily accessible.

The Tel-O-Set Ratio Relay offers these unique features:

★ **LINEAR RATIO**

Output changes in straight-line relation with primary variable. Permits better control tuning . . . eliminates "compromise" settings.

★ **DIRECT OR REVERSE ACTION**

Readily set to provide either increasing or decreasing output . . . increasing or decreasing ratio.

★ **FLEXIBLE ADJUSTMENT**

Ratio range can be reduced to any desired value. Reduced span can be positioned at any desired portion of the maximum range. Factory setting is 50—150% ratio range.

★ **WIDE RANGE**

Ratio can vary from 0 to 200% for a full scale change in the primary variable.

★ **ADJUSTABLE LIMITS**

Readily set stops are provided to limit minimum and maximum output pressure.

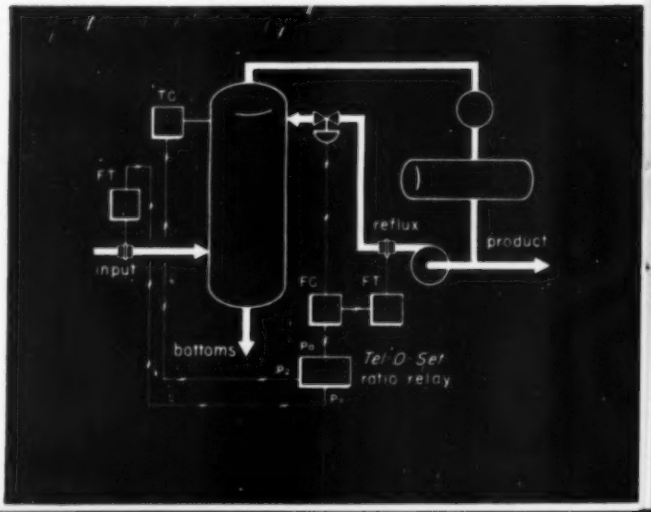
★ **ZERO SUPPRESSION**

Independent zero adjustments permit selection of the exact input-output relationship desired.

★ **INDICATING GAGES**

Separate indicators show output pressure and both input pressures.

On a distillation column, Tel-O-Set Ratio Relay receives air signal (P_2) from column temperature controller. This signal varies the ratio of the output pressure (P_0) to the signal received (P_1) from the input flow transmitter. Output pressure feeds into an *Indexet* remote setting index in the flow controller, to reset this instrument and thus throttle the valve in the reflux line. Ratio of reflux to input is thus varied in accordance with temperature of the top of the column.



New, versatile means for effecting cascade control

the Tel-O-Set Ratio Relay

HAVE a complex control loop? Here's a versatile way to simplify it . . . the new *Tel-O-Set* Ratio Relay. Another advanced idea in process control from Honeywell, this unique relay proves the ideal solution to complex cascade control problems.

The Ratio Relay provides automatic control with a single element influenced by three interrelated variables. For example, it is used on distillation columns (see diagram) to control the ratio of reflux to feed, as column temperature varies. In absorption towers, it regulates ratio of absorbent and feed stock to give constant concentration of product. And there are scores of other uses for this relay . . . in evaporators, controlled-atmosphere furnaces, reaction tanks, engine testing and other applications where several related variables must be interlocked for efficient operation.

The Ratio Relay receives pneumatic signals from remote transmitters, controllers or manual loading stations. It produces an output air signal for readjusting the set point of a secondary controller. It is the ideal companion for Honeywell Differential Converters, *Tel-O-Set* miniature instruments and Brown pneumatic controllers.

Your nearby Honeywell sales engineer will be glad to discuss applications to your specific process . . . and he's as near as your phone.

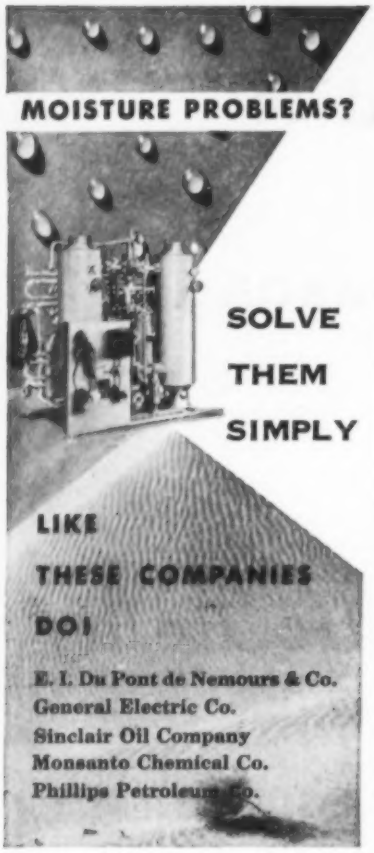
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA:** Write for Bulletin 8410, "*Tel-O-Set* Ratio Relay."

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls



. . . and dozens and dozens more of the country's leading firms, technological schools, the armed services, the U. S. Atomic Energy Commission . . . *all* choose Pritchard HYDRYERS* for efficient, dependable dehydration of compressed air and other gases for instrument and process controls.

Standard packaged units reduce dew points to minus 40°F...custom units for extreme conditions or special requirements.

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COOLING TOWERS • SPECIALIZED HEAT EXCHANGERS • GAS & AIR TREATING EQUIPMENT

As Management Sees It . . .

The New Tax Law—Challenge to Business

Here are some tips on how to utilize the new revenue code to the best advantage.

Part II

James B. Kobak, CPA,
Partner J. K. Lasser & Company

THE NEW INTERNAL Revenue Code is loaded with incentives that challenge every business man and with concessions that will aid employes.

Here are some of the ways the new law can help your employes:

Injury and Sickness Benefits—Under the old code, workers did not pay tax on sickness or injury benefits from plans financed by their employers under contracts with insurance companies. But they had to pay on benefits received under plans that the employers financed themselves. Now that's been changed. You can now arrange for your employes to get benefits, without tax, under a plan that you finance, provided that the benefit payments meet any of these conditions:

- The payments are reimbursements for medical expenses incurred by the employe for himself, his wife, or for other dependents.
- The payments are for permanent loss or loss of use of part of the body, or for permanent disfigurement of the employe, his wife, or other dependents. In this case, the payment is based on the kind of injury and has no relationship to the length of time that the employe is out of work; the payment is not for medical expenses. So the employe can deduct any medical cost he has in connection with his injuries, without having to worry about having them reduced by the amount of the payment.
- The payments are wages or for loss of wages for the period the employe is out of work because of sickness or injury. The worker pays no tax on any amounts up to $100 a week of such payments. However, the exemption does not apply during the seven days of absence unless the absence from work is due to an accident, or unless the worker is in the hospital for at least one day during his absence.

Example: Jones is out sick for ten days. He is not injured and does not have to go to the hospital during that time. He gets payments for the full ten days. But payments for only three of the days are tax free.

Suppose, however, that on the eighth day, Jones is admitted to a hospital. He stays overnight and is discharged the next day. He can leave out the payments for the entire ten days, based, of course, on the maximum of $100 a week.

Smith, on the other hand, is out sick, not in the hospital, for three days. On the fourth day he is injured. This keeps him out of work five days more. He can't exclude payments for the first three days but he can for the next five—again on the basis of not more than $100 a week.

Death Benefits—The old law said that payments up to $5,000 by an employer to the beneficiaries of a dead employe were tax free. But there had to be a contract calling for the payments. Now there's no tax—even without a contract.

Treatment for Stock Options—The new law gives to the so-called "variable price options" the same favorable tax treatment provided for "restricted stock options." Stock options no longer have to be in terms of a specified dollar amount; the option price can now be based on a formula. This means you have an easy way to protect your employes against a falling market.

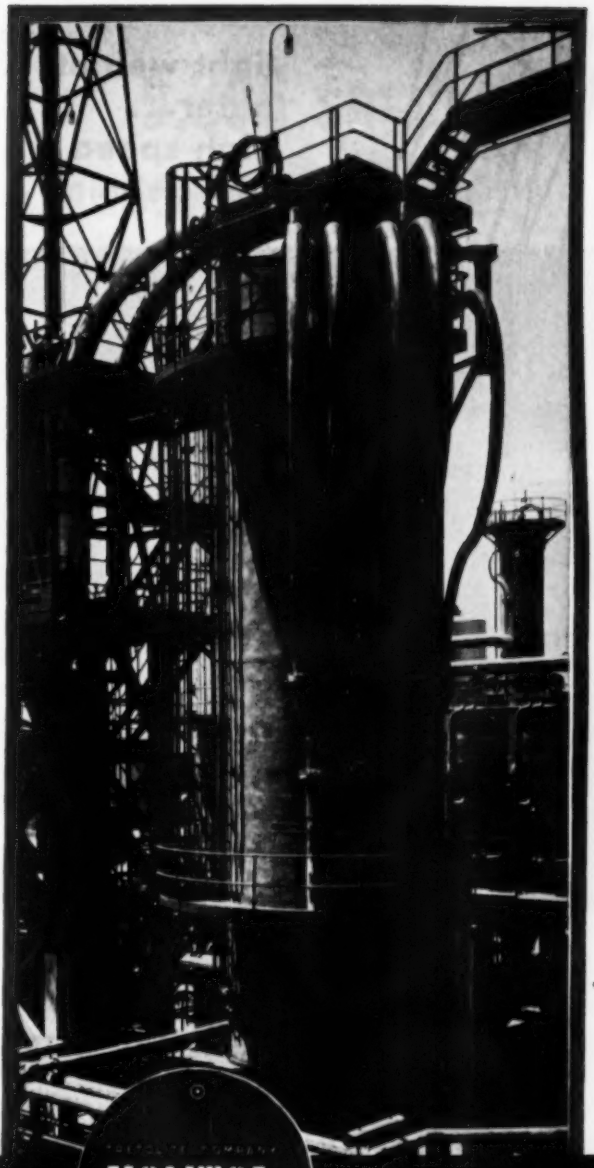
Here's how you can work it: You peg the option price at a percentage (not less than 85 percent) of the value of the stock during a six-month period

HOW MUCH DOES CORROSION INCREASE YOUR MAINTENANCE COSTS?

Corrosion takes a heavy toll throughout the entire oil industry. In the refinery, handling large volumes of oil at high temperatures, the cost of replacing damaged metal equipment is greatest. It has been estimated that the overall cost of corrosion to refiners is as much as $250,000,000.00 per year, *not including the cost of shut-downs and lost on-stream time!*

Losses in such magnitude reflect tremendous metal loss, equipment damage and maintenance expense. Unless you carefully use every means at your command to combat corrosion, your refinery may be carrying an undue share of this economic burden.

Why not get all the facts on the use of Kontol Corrosion inhibitors in the refinery? They may help you cut your maintenance costs substantially.



IN THE REFINERY KONTOL **PROTECTS:**

Crude Stills
Debutanizers
Depentanizers
Gas Absorber Plants
Cat Cracker Fractionators • Stabilizers
Platformers • Reformers • Vacuum Towers • Desulfurization Systems • Gas Recovery Systems • Coking Systems
Alkylation Plants • Alkanolamine Sweeteners • Dewaxing Systems • Kontol protects carbon steels, alloys such as admiralty metal, cupro-nickel, stainless and others

HR 54-13

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A DIVISION OF PETROLITE CORPORATION
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Chemicals and Services for the Petroleum Industry

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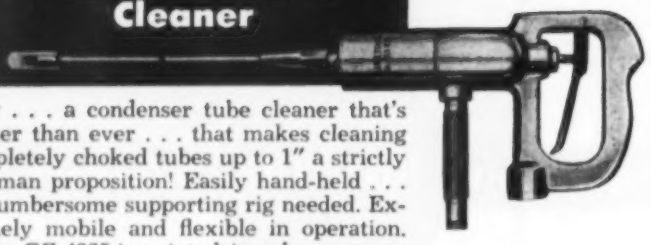
For more data on advertised products, use Readers' Service Cards, last page.

NEW

light weight...
quiet...
high speed...
fast cleaning...

the AIRETOOL CC-4325 Condenser Tube Cleaner



Now . . . a condenser tube cleaner that's lighter than ever . . . that makes cleaning completely choked tubes up to 1" a strictly one-man proposition! Easily hand-held . . . no cumbersome supporting rig needed. Extremely mobile and flexible in operation.

The CC-4325 is quiet; driven by a powerful two-stage, muffled, air motor with a built-in flushing system that insures cooler running of the drill. A quick shut-off sleeve valve controls the flushing agent, and a trigger type valve controls motor speed. When used with a carbide tip drill, the CC-4325 makes short work of cleaning tubes completely choked with hardest deposits.

The New CC-4325 Condenser Tube Cleaner is only one of the new developments of The Airetool Mfg. Co., for many years leaders in the field of tube cleaning and expansion tools. There's an Airetool tube cleaner and expander for every type of tubular construction . . . Write for complete details.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

BRANCH OFFICES: New York • Chicago • Philadelphia • Tulsa • Houston • Baton Rouge
Representatives in principal cities in U.S.A., Canada, Mexico, South America, England, Japan

As Management Sees It . . .

or some shorter period within that six months. The six month period has to include the day on which the option is exercised. If the stock declines between the time the option is granted and the time the employe exercises it, he is fully protected against the drop. (Under a fixed option, he would have had to pay a specified dollar amount—amounting to at least 85 percent of the market value of the stock at the time the option was granted—regardless of what happened to the market price afterwards. The only requirement for the variable price option is that the employe would have had to pay at least 85 percent of the stock's market value at the time of granting if he had exercised it then.)

It might be a good idea to give your employes two stock options now. One would be for a fixed dollar amount. The other would be a variable price option. If the price of the stock goes up, the employe exercises the option with the fixed price. If the market value goes down, he exercises the variable price option. Either way, he gets the stock at the lowest possible price.

Meals and Lodging—The new law liberalizes the rules about board and lodging as income. An employe has no taxed income if he gets them where he works—provided they are given to him for the convenience of the employer. It makes no difference whether you intend the meals or lodging as part of the pay to workers. The only condition is that they are furnished on the premises, and that workers have to take them as a condition of employment.

Salesmen's Expenses—The law now allows for the deduction from gross income of local transportation costs and the business expenses of outside salesmen. It used to be that employes had to give up the standard deduction to get many of these expenses. Or, if they used the standard deduction, they lost the actual expense items. With the new changes you may want to think about giving definite authorizations to your employes to make certain outlays for local transportation costs and sales expenses. That way they get support for the validity of their deductions. And it costs you nothing.

This is what the law says now: An outside salesman no longer has to prove that he is an independent contractor. Even if he is an employe, he is considered a contractor for tax purposes. That means all expenses connected with his job are deducted from

9,896 small businessmen help us serve you well

Back in Grandpa's day, horse-drawn tank wagons like this delivered Pearl Oil Kerosene and Eureka Harness Oil to Standard customers. It was a delivery system good enough for the times—but not good enough for a company with a growing demand for its products and a policy of putting them within reach of everyone.

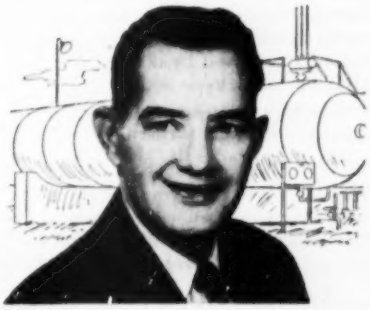
8,329 Independent Chevron Dealers like Jim Davenport, of Phoenix, Arizona, bring Standard's products to motorists.

725 Independent Distributors, like H. G. Hathaway, of Grants Pass, Oregon, distribute our products in rural areas.

188 Independent Marine Dealers like Ted Engstrom, of Olympia, Wash., retail Standard products to Western boatmen.

235 Independent Heating Oil Dealers like F. L. "Doc" Howard, Boise, Idaho, are retailers of Standard Heating Oils.

101 Independent Liquified Gas Dealers like Fred La Frentz, Cedar City, Utah, distribute butane and propane gases.

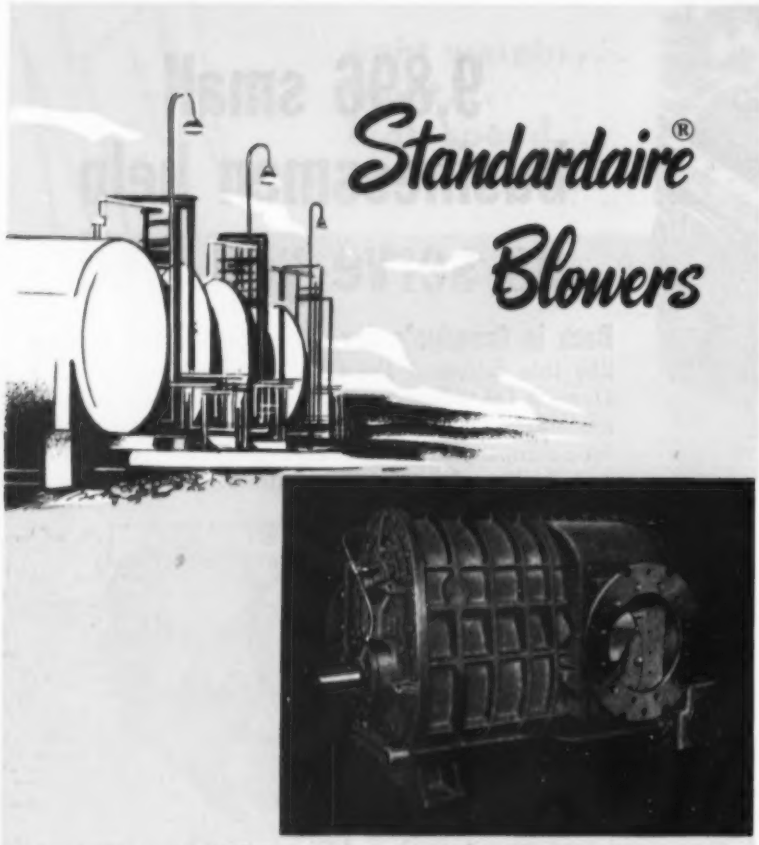


318 Independent Airport Dealers like Howard S. Fisher, San Diego, Calif., supply Standard products to Western planes.

Ever hear the one about big companies "squeezing out the little fellow"? You'd have a hard time convincing these 6 men—or the 9,890 independent businessmen like them who team with us to bring you Standard Oil Company of California products quickly, conveniently, economically. They form the nucleus of a distribution system that reaches every corner of the West. Each of these men operates his own independent company; together they employ 27,976 people. You probably know some of them because they contribute to the community life and prosperity of thousands of Western towns. Their undertakings are not only based upon Standard products, but operated and expanded with the help of scores of business aids Standard supplies without charge. We do all we can to help them prosper for Standard knows a big company can't succeed without the help of small businessmen. It takes both to serve you well.

STANDARD OIL COMPANY OF CALIFORNIA

75 years of planning ahead to serve you better



safely handle large volumes of gases...

... Thanks to *Standardaire's* new, mechanical positive face type shaft seals, which effectively seal the gas within the rotor chambers.

You'll discover there is no pressure surge, pulse-beats, or internal losses with a *Standardaire Blower. Standardaire's* smooth, even compression is achieved by the cycloidal form, screw type rotors which discharge gas or air, without shock, from the pockets formed between the rotor blades.

***Standardaire Blowers* move more gas or air, with less wear, and with lower maintenance and power costs than other blowers of equal weight or size.**

Write today for *Standardaire's* fact-filled Bulletin B-154.

READ STANDARD
CORPORATION

BLOWER-STOKER DIVISION
370 Lexington Avenue
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Read Standard also manufactures a complete line of blenders for laboratory and industrial use. For information write Read Standard Corp., York, Pa.

gross income to find adjusted gross income. In other words, he can use the standard deduction and still deduct for all travel expenses away from home, plus entertainment costs, secretarial help, telephone, telegraph, and the like.

On local transportation costs, an employe can now deduct what he spends from gross income to find his adjusted gross income. This means he can write off cab fares and tips, bus fares, subway fares, and automobile costs. Of course, these deductions are limited to the costs that are necessary in his job. Commutation costs are not deductible.

Social Security Expanded, Too—In addition to the employe benefits that Congress packed into the new tax law, the administration put through an expanded Social Security Act. Benefits have been increased, and coverage broadened. Don't overlook their value to employe morale.

Here are two examples of what the new Social Security ammendments mean in dollars and cents:

Assume a man dies at 40, leaves a wife and two children, one and four years old. If he has been earning an average monthly wage of $350 or more, his family could receive over the years a total of $57,042—tax free—from the government.

It breaks down like this: Until the younger child is 18, the widow gets $15,530, the younger child $13,430. The older child gets a total of $10,500 over the years until he is 18.

After the younger child reaches 18, there is a cutoff in benefits to the widow. However, when she reaches 65, she again gets Social Security benefits. On the basis of her life expectancy at age 65 (according to the 1937 Standard Insurance Annuity Table) she will get a total of $17,582.

Even a retired childless couple—or a couple with no child under 18—can do better than you might think. Under the new law, a retired man and his wife (over 65) might collect a total of $37,112—based on an average life expectancy at that age.

The breakdown: During the husband's life, he gets $19,532, his wife $9766. After his death, his widow would collect $7814 before she dies.

The annual Social Security payment received by this man and his wife thus comes down to $1953. On its face, that doesn't look like much. But don't forget that the capital required to produce that amount each year at 4 percent would be $48,825. # #

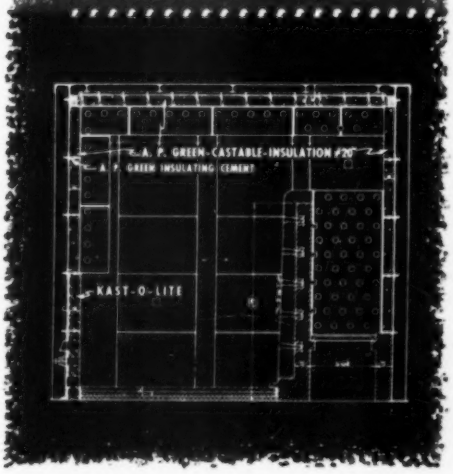
End of Part II and series.

6 REASONS WHY

A. P. Green REFRACTORY PRODUCTS

A. P. GREEN

LIGHTWEIGHT CASTABLE REFRACTORIES REDUCE COSTS AND INCREASE EFFICIENCY IN OIL HEATERS AND OIL STILLS



Cross section drawing of an oil heater in Gary, Indiana. This heater is one example of the numerous uses for A. P. Green lightweight castable refractories in the petroleum industry.

For use in panel casing construction in new or old oil heaters and stills, A. P. Green castable refractories offer you these 6 advantages:

1. Lightweight insulating castables reduce heat loss . . . improve temperature control and heat distribution.
2. Securely anchored lining—gives long, trouble-free service.
3. Increases the performance and efficiency of the furnace. With fewer joints, air infiltration is reduced to a minimum.
4. Simplified construction—reduce erection time.
5. Lowers maintenance costs. Any tube section may be repaired by removing a series of the panels without disturbing the balance of the furnace arrangement.
6. Lower foundation costs due to the use of lightweight materials.

The A. P. Green Engineering Department will assist you with further information on the application of these materials to new units or the conversion of existing furnaces. Call your local A. P. Green distributor — he's listed in the yellow pages of your telephone directory — or write . . .

A. P. GREEN FIRE BRICK COMPANY
Mexico, Missouri, U. S. A.
PLANTS: Mexico, Mo. • Woodbridge, N. J. • Sulphur Springs, Texas
IN CANADA: **A. P. GREEN FIRE BRICK COMPANY, LTD.**
Toronto 15, Ontario
DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE WORLD

The castable is poured and anchored to the steel panels on the job site. The simple formwork has been removed and the panels are awaiting erection.

Interior view of side wall showing panels being erected.

View of outside panel casing.

For more data on advertised products, use Readers' Service Cards, last page.

REFINING PROBLEMS

Continued from page 96

materially to the present excess of motor fuel, my reply is that I have not found reliable evidence to back up this point of view. It will be recalled that the reduction of tetra-ethyl lead in gasoline for military aircraft called for a higher percentage of alkylate in the new avgas blends.

Noteworthy is the fact that the current over-supply of gasoline is largely limited to the inland section of the nation. A recent American Petroleum Institute report which compares stocks on hand, August 20, 1954 versus August 21, 1953, makes possible the following summation:

SECTION	THOUSANDS OF BARRELS		
	Year 1953	Year 1954	Change '53-'54
East Coast	32,900	34,600	+ 1,700
Gulf Coast	26,600	27,100	+ 500
Inland	62,700	74,900	+12,200
California	20,500	18,400	— 2,100
Total	142,700	155,000	+12,300

The same source of information shows that stocks of kerosine and heating oils are at levels consistent with anticipated needs. And on the West Coast only is there a relatively long supply of residual fuels.

I believe that a reasonable amount of marginal capacity for refining the entire crude barrel is desirable. There have been in the past, and are bound to be again, conditions which change —on short notice and for varying periods of time—the accustomed relationship between supply and demand. Unquestionably, the industry should provide a factor of safety in its capacity large enough that adjustments to gain operating flexibility, normal maintenance of equipment, and moderate increases or shifts in product demand will not result in shortages. To define this factor of safety for the U. S. as a whole, in terms of barrels per day or as a percentage of existing capacity, appears to be impracticable, primarily because of situations peculiar to individual refiners. Probably in most instances a marginal amount not to exceed 10 per cent should suffice for all extraordinary conditions short of war.

My thought is that the best the industry can do at present with its one really major problem—over-production of motor gasoline—is to practice better observance of the law of supply and demand; that is, to make a reaffirmation of faith in this governor of economic activity. I am confident that, by so doing, more of problem-preventing and less need for problem-solving would follow.

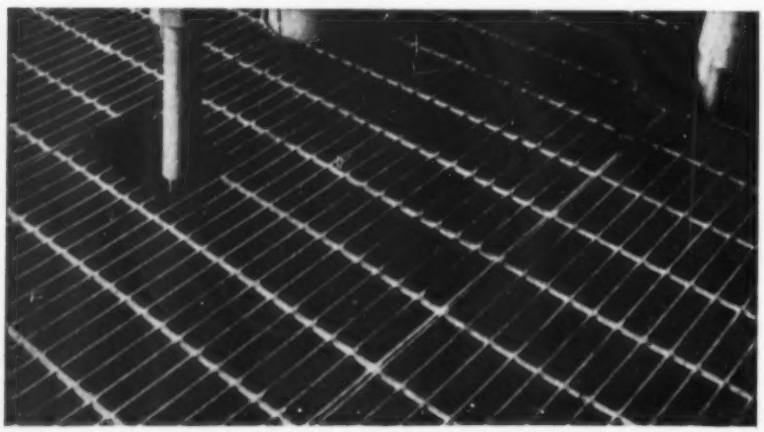
MICHAEL HALPERN, Senior Vice President, The Texas Company

THERE IS NO DOUBT that the petroleum products inventory situation in this country got somewhat higher than necessary during the year. Some increase in products inventories from year to year is, of course, to be expected as the natural result of the continual growth in the volume of products sold. Further, in recent years many refiners have tried to keep their operations at a more efficient level by running to the greatest extent possible at uniform rates and to the same product yields on a year round basis. This requires additional storage for distillate during some parts of the year and for gasoline during others. Although some increases in inventories result from this procedure, the over-all effect is a desirable one both from the standpoint of refining costs and of the balance between supply and demand.

Aside from the increases in inventories discussed above, there has been an accumulation of product supplies above the required operating levels. This is due primarily to the failure of product demand to reach the volumes predicted for the year. With refinery running schedules established to meet an anticipated demand greater than that which actually developed, some increase in inventories was inevitable.

As soon as the true situation became apparent, many of the individual companies curtailed their refinery thruputs in an effort to reduce their inventories. Some improvement resulted, but inventories are still higher than is necessary. With some increase in general business activity, however, and with continued attention on the part of refiners to maintaining their own running in line with their product requirements the industry should enter 1955 in a reasonably satisfactory position.

Most companies now have more refining capacity than is needed to meet their current product volume demands. For such companies an important element of good management is the forecasting of the probable demands for their products. Since such forecasts are used as a basis for the establishment of refinery running schedules, it is evident that their accuracy will have an important influence on changes in product inventory levels. As a means of keeping its inventories



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We'll send this handy paper weight if you request it on your company stationery.

Standard Steel Spring Division
ROCKWELL SPRING AND AXLE CO.
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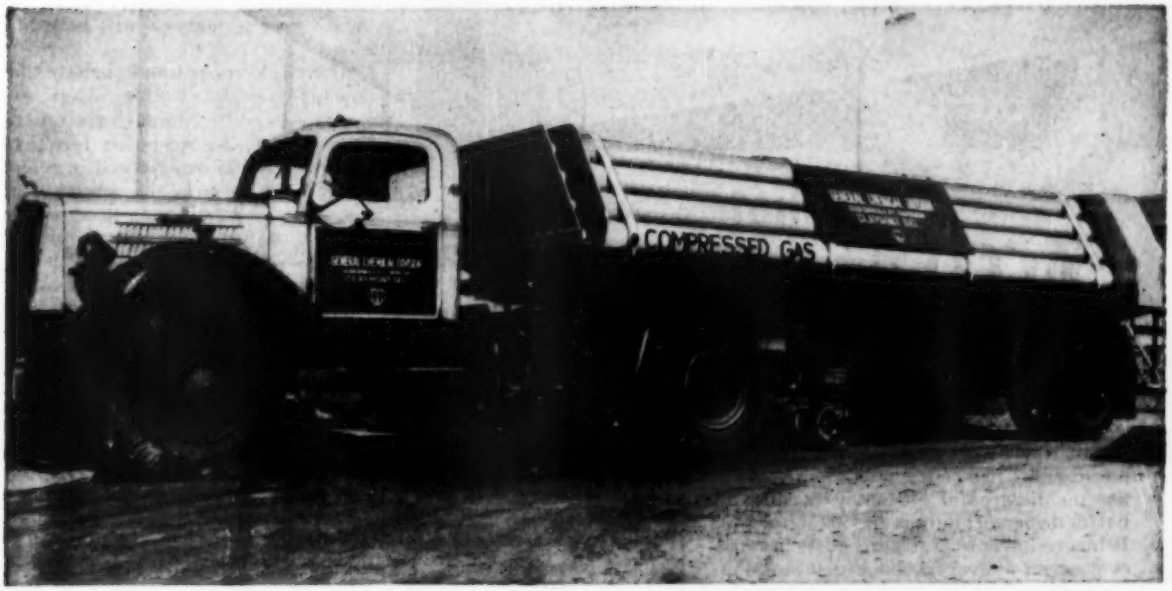
NEW hydrogen transport solves refiners' storage problems

Semi-trailer with 30 or 38 tubes is delivered to point of usage. Capacity of 30 tube unit is 39,000 cu. ft. at 2400 psi; of 38 tube unit, 50,000 cu. ft. at 2400 psi.

Taylor-Wharton can also furnish individual storage cylinders, made to ICC 3A2400 classification and qualifying under API-ASME for 1450 psi.



Semi-trailer Mounts 30 or 38 Tubes for Mobile, Compact, High Pressure Hydrogen Storage

In response to hydrogen storage problems faced by new platforming process plants, Taylor-Wharton offers two kinds of high pressure cylinder installations, the permanent and the transport, now successfully used in the chemical industry.

Investigation of high pressure equipment will reveal the economy of this method of storage. (Low pressure storage requires an expensive compressor.) The tubes readily provide a flexible supply of hydrogen to get you "on stream" quickly. High pressure storage saves space, packing up to 50,000 cubic feet of hydrogen at 2400 psi in the transport.

Write now for Bulletin 300 which will show you the economy of Taylor-Wharton cylinders for your hydrogen plant.

Taylor-Wharton high pressure transports efficiently store and deliver for Allied Chemical & Dye Corporation. High storage capacity and mobility will save handling dollars and floor storage space for you too.

Modern heat treating facilities for tubes at Taylor-Wharton Iron and Steel Company.

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TAYLOR-WHARTON IRON & STEEL COMPANY

CINCINNATI 12, OHIO

Also Manufacturers of: Manganese Steel aCstings, Alloy and Carbon Steel Castings, Special Trackwork, Gas Cylinders

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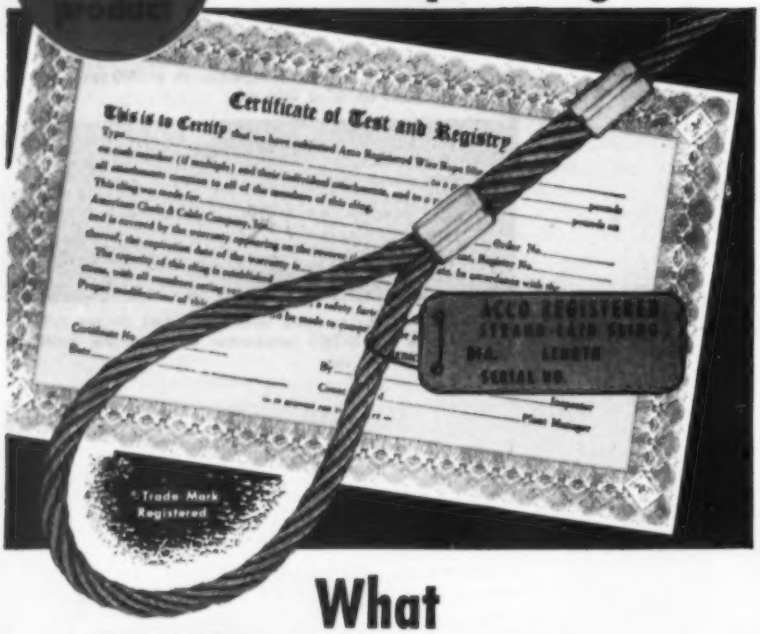
ACCO Registered* Wire Rope Slings



What ACCO Registered Means

• Primarily it means greater safety for your men and machines when loads are carried in the air in your shop. It means insurance against dropping a load which could tie up production.

But that's only part of the story. The name ACCO *Registered* on the slings you use means greater efficiency because of better design of endings and attachments. It means lower overall sling costs because every part of every ACCO *Registered* Wire Rope Sling has the same strength as the catalog breaking strength of the rope itself. ACCO even magnafluxes each hook to make doubly sure it will serve you well.

And it means that the sling has been proof-tested at the factory to twice its rated capacity. You can be sure that every ACCO *Registered* Wire Rope Sling is the safest, strongest and lowest cost lifting tool you have ever used.

Best of all, you can get them when you need them from a nearby stock. Contact your ACCO *Registered* distributor today for full information and prices. Or, write our Wilkes-Barre, Pa., office.

1 The best material
2 Unit safety factor (on bodies, rings, links, safety shackles, hooks)
3 Proof test of complete sling to twice rated capacity
4 Actual field service test of each model
5 Metal identification tag on each sling
6 Signed Registry Certificate with each sling

ACCO
TRADE MARK

Wire Rope Sling Department
AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. • In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

Also Links Shackles Hooks

As Management Sees It . . .

within satisfactory limits, The Texas Company has developed the procedure of establishing year-end inventory goals. Running schedules are adjusted from time to time during the year in accordance with product sales to permit attaining the desired inventory levels at the end of the year.

The magnitude of the present surplus of refining capacity is undoubtedly a matter of some concern. However, because of the time required to get additional capacity installed and into operation, it is desirable that some capacity over that currently required be available to provide for growth in the demand. Since large refinery processing units are both more economical to build and to operate, it is inevitable that there will be relatively short periods when a higher capacity than is neeeded will be available.

There is every reason to believe that demand for petroleum products will increase steadily. Although the rate of increase may be somewhat less than the industry has experienced in recent years, it seems to be the concensus of petroleum statisticians that within about three years, additional refining capacity will have to be provided to maintain a reasonable margin of safety between the total capacity and that actually needed to meet the then current demand.

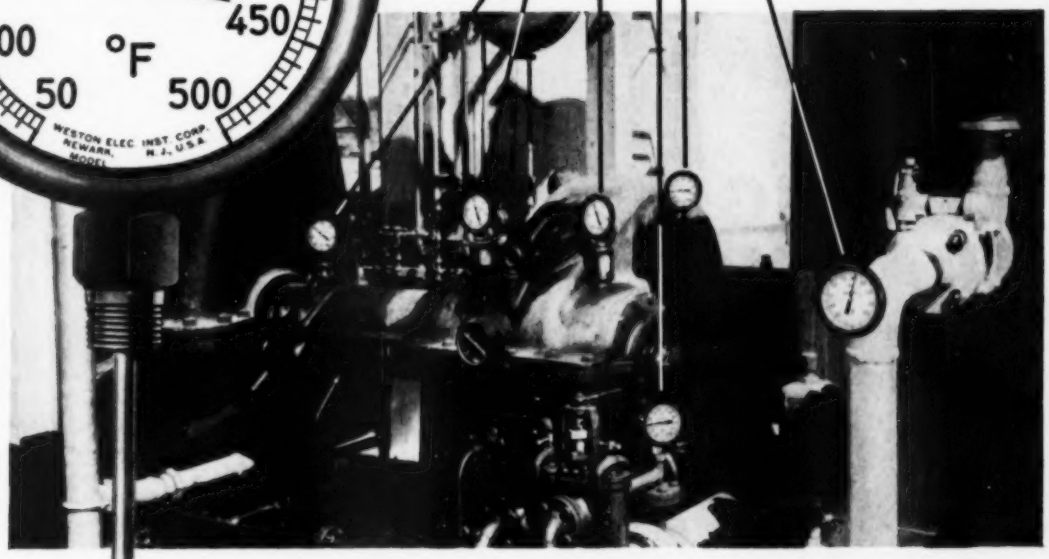
R. L. TOLLETT, President, Cosden Petroleum Corporation, Big Spring, Texas.

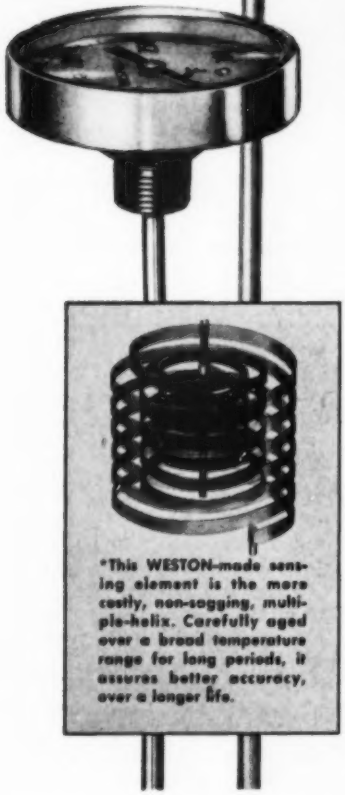
GASOLINE INVENTORIES are above the levels at which reasonably profitable selling prices can be maintained under pressure from short-sighted buyers. That our national inventory of gasoline is 12½ million barrels above the level of a year ago does not necessarily indicate excessiveness. The industry produces about 3⅓ million barrels daily. In any other industry that I know of, an accumulation of less than four days' production would not be serious.

We do have a buyer's market and I refer to some of the buyers as short-sighted because they will not bid prices that they can afford to pay for a quality product. The lows of quotations in price publications are below the levels at which buyers could obtain their requirements through arrangements for processing crude oil to be obtained at prevailing posted field prices. Most of the big buyers are producers of crude oil. I feel that they are short-sighted in obtaining their supplies at prices that will require their suppliers

For more data on advertised products, use Readers' Service Cards, last page.

AT EVERY CHECKPOINT





*This WESTON-made sensing element is the more costly, non-sagging, multiple-helix. Carefully aged over a broad temperature range for long periods, it assures better accuracy, over a longer life.

WESTON *all-metal* THERMOMETERS

(with Multiple Helix*)

Here's another typical example of how large processing plants have solved temperature checking problems, and cut thermometer costs besides. With a WESTON dial-type thermometer at every checkpoint, temperatures are read at a glance . . . in far less time, and with far greater accuracy. Their sturdy all-metal construction resists breakage, gives them far longer life on operating equipment. And the exclusive WESTON multiple helix employed assures dependable accuracy during all this long life.

Available in a broad selection of types, sizes, ranges and stem lengths, WESTON thermometers are today standard on all types of mobile and stationary equipment and machines, large and small; as well as on piping, conduit, ducts, etc. Ask your distributor, or local WESTON representative for complete information, or write for descriptive bulletin . . . WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON 5537 *Thermometers*

Stocked by leading Distributors

For more data on advertised products, use Readers' Service Cards, last page.

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YOUR SOLUTION IS IRVING GRATING

For heavily abused areas:

IRVING Continuity Armouring

concrete-filled steel grating floor will not crack or break up. Inexpensive to install, it eliminates costly repairs AND IS SAFE.

Non-Sparking and Corrosion-Resistant ALUMINUM GRATING

extra-light, self-draining, self-ventilating, economical, strong and durable.

Perfect for Chemical Plants where fire is a hazard.

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for Castable Ganister Linings used in refractionating units.

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As Management Sees It . . .

to operate unprofitably. I do not suggest that the buyers subsidize their suppliers, but I do feel they should pay a fair price for any material purchased. If the big buyers can obtain their requirements from their own plants, it is an indication that they used good judgment in balancing refining capacity with market demands. If the marketer does not need gasoline, there is no reason for him to buy it; but if he needs it and does go into the market, I think he should pay a fair price—certainly no less than he would expect for a similar product, should he be in a long position.

If the big buyers continue hammering prices down by buying from refiners in distress, their suppliers will endeavor to reduce the cost to them of crude oil, out of which to make low-priced gasoline. In our industry our principal raw material, which is crude oil, sells for about six times as much as it costs to process it, and nine or ten times as much as direct labor costs in processing. The only way that a refiner can materially reduce costs is to get his crude oil at a lower price.

Unless there is an improvement in gasoline prices at the refinery level, it is reasonable to expect some refiners to import their crude oil requirements to reduce costs. Failing to get cheaper crude oil through importing will lead to reductions in posted field prices for domestic production. It seems to me that some of the companies are putting in jeopardy their revenues from crude oil production by buying gasoline at prices that will require their suppliers to put pressure on the presently favorable crude oil price structure.

There could not be any very substantial amount of excess refining capacity. Every refinery should have a reasonable reserve, and I think most of them have. The reserve capacity is sure to be the less efficient equipment that can operate profitably only on marginal throughput. In these critical times, only the most efficient equipment should be operated, because it behooves all of us to get the maximum realization in dollars and cents out of every barrel of crude oil to maintain the present crude oil price structure. The refiner has got to make a profit to stay in business, and nobody wants any plant to shut down completely. Such a situation always makes for trouble, because some enterprising operator will try to bring the plant back on stream through obtaining crude oil below the posted field prices.

In my opinion, the reason consumption of gasoline has not increased more this year over last than was estimated is that there is a great deal of truth in the claims that superior gasoline is now being marketed. Motor vehicles are actually getting more mileage out of gasoline than was realizable a year or so ago. This is especially true of motor vehicles that use premium grades. The engines seem to be just as efficient at 25,000 miles as when new. To a considerable extent, the claims made in advertisements are realizable and the measure of the claims is to be found in reduced consumption per unit.

BRUCE K. BROWN, President, Pan-Am Southern Corporation, New Orleans.

THE BIGGEST SINGLE short-range problem presently facing the American petroleum refining industry is to complete the job of reducing crude and product inventories to eliminate surpluses. This is necessary in order to assure that refined petroleum products can be sold at the refinery for as much or more as it cost to produce them.

Gasoline inventories in Districts 1 and 3 now bear a sound relationship to anticipated demand in those areas. District 2 still has too much gasoline in inventory. Kerosine and distillate stocks east of the Rockies are almost exactly the same as a year ago. Here again, however, District 2 is in trouble, because it is the area in which these stocks are greater than last year; offsetting lower stocks in Districts 1 and 3. If the coming winter is a so-called "normal one" (instead of "mild"), the stocks available may be too low for comfort unless refiners make more heating oils by increasing heating oil yields *as well as* crude run. It is not enough merely to increase crude run.

This type of maladjustment has occurred before and will happen again. Hence we are justified in looking backward to see what caused the trouble and how it was cured and looking forward to see if some better plans to avoid trouble in the future can be invented.

The oversupply now being worked off stemmed from climatic conditions —a winter too warm (at least too warm to suit oil men), followed by a poor agricultural season. When the warmth of last winter cut the demand for, and dropped the bulk price of, heating oils in the Gulf, refiners shifted too soon, too much, toward increased gasoline yields and increased crude runs. What happened after that, all refiners know. The trouble that was bound to come anyway as the result

CHEMICAL PROCESS NEWS

PUBLISHED BY CHEMICAL PROCESS DIVISION, THE M. W. KELLOGG COMPANY — OCTOBER 1954

NOTES ON PHENOL-FROM-CUMENE

Cumene, a war-time antiknock component for aviation gasoline for which Kellogg originated a manufacturing process and built a number of plants, is again in the news. Currently the company is building a plant, after having developed the mechanical design in which cumene will be produced and then used as an intermediate for manufacturing phenol in the Hercules-Distillers phenol-from-cumene process.

* * *

In this process, cumene is first oxidized to form cumene hydroperoxide. The latter is then split in a cleavage reaction into phenol and acetone, the two major products. The reaction also produces a small amount of methyl styrene.

* * *

The over-all process is an excellent example of how certain refinery products can be upgraded to industrial chemicals with a concomitant radical increase in value.

* * *

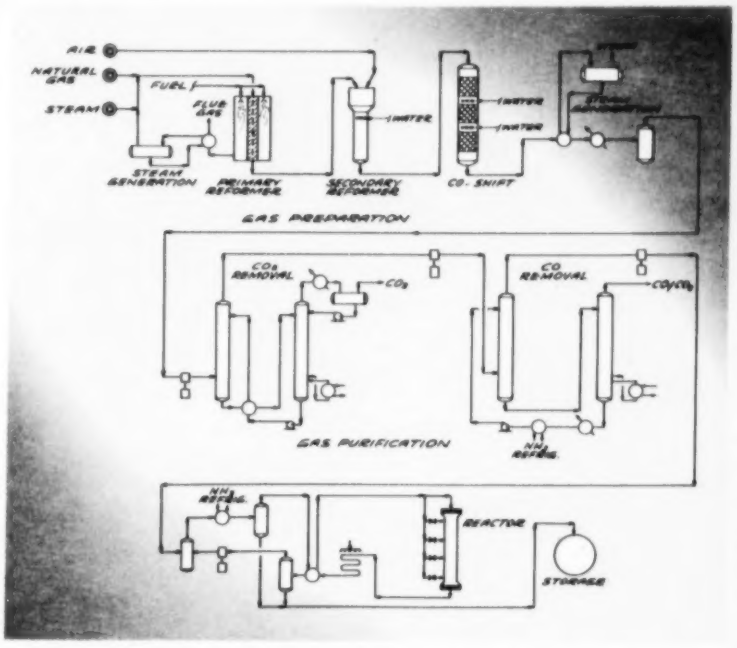
For example, propylene—a refinery by-product available at relatively low cost—makes up a third of the original feedstock volume when it is combined with benzene by alkylation to form cumene. After oxidation and cleavage, phenol is obtained from the benzene part of the initial input, and the low-cost propylene third of the input yields a substantial amount of acetone.

* * *

Thus, at present prices, acetone can be regarded as an attractive bonus for the producer—over and above the phenol produced as the major product. Moreover, the small quantity of methyl styrene made in the process can either be reconverted to cumene and used again or it can be sold to consumers in the plastics industry.

* * *

In addition to these favorable economic aspects, the process features low initial investment and operating expense. High pressures and temperatures are not used, and the consumption of chemicals such as alkalis and acids is comparatively low.



Unusually Low Investment Cost for Large, New Plant to Produce Ammonia

Kellogg has just been awarded the contract for a large ammonia plant which will make this basic fertilizer ingredient at the unusually low investment cost of approximately $50 per ton of annual capacity.

The plant, scheduled for completion in mid-1955, will be erected near Lima, Ohio, for The Standard Oil Company (Ohio). It will produce 300 tons of ammonia daily.

The major reason for the reduction in investment lies in the fact that the process employs only one ammonia synthesis section. Furthermore, operating experience with Kellogg ammonia converters has shown that they can be substantially reduced in size as can the heat exchangers without lowering capacity.

From the standpoint of operating costs, the new plant will have electrically-driven centrifugal compressors with concomitant savings in cooling water per-ton-of-ammonia produced.

As may be seen from the flow sheet, the plant will charge natural gas to a reformer where about 70% of the feed is converted into raw synthesis gas. This mixture is then fed to a secondary reformer where nitrogen in the form of air is introduced into the stream. Heat of combustion supplies the energy necessary to reform the remainder of the natural gas and to elevate the temperature to 1700°F.

As the mixture leaves this reformer, it immediately enters a quench vessel where its temperature is lowered by direct water quench. This not only brings the temperature down to the required shift reactor temperature but also provides the steam for the shift reaction.

From this point the mixture is fed to a gas purification section, the first step in which is a shift reaction. This converts the CO in the stream to CO_2, simultaneously producing H_2 as a result of the reaction with water in the form of steam.

Carbon dioxide removal, employing a regenerative MEA system, follows this step. This method of removing CO_2 has five advantages: no oxygen contamination, negligible synthesis gas loss, essentially complete removal of CO_2, the production of CO_2 in a pure usable form, and compactness of equipment.

Following this purification operation, traces of carbon monoxide left in the stream are removed. The synthesis gas is then passed through exchange and charged to the catalytic converters. The product gases from the converters are cooled in water coolers and then by exchange with

(continued on the following page)

KELLOGG
ETHYLENE PROPYLENE BUTYLENE
KELLOGG
METHANOL ETHANOL PROPANOL
KELLOGG
BUTANOL ISO OCTYL ALCOHOL
KELLOGG
BENZENE XYLENE TOLUENE
KELLOGG
PHENOL FROM CUMENE
KELLOGG
AMMONIA UREA
KELLOGG
GLYCERIDES
KELLOGG

(continued from previous page)

converter feed gas in the recycle gas exchangers. Anhydrous liquid ammonia is separated out in the primary separator and, after further cooling to 25° F in a refrigeration system, goes to an anhydrous ammonia product flash drum.

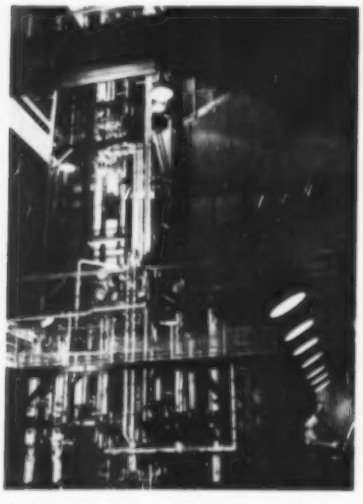
Six Solexol Plants in Six Years

In the six years since the process was first perfected in its laboratories, Kellogg has designed and built a total of six Solexol refining plants. The most recent one, a strategically important plant located in Norway, will among other things enable that country to double its production of glycerine.

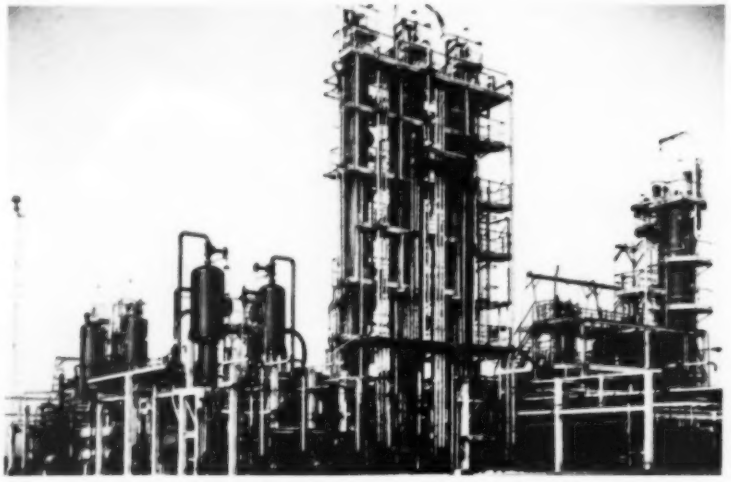
Solexol refining is a liquid-liquid extraction process—utilizing propane as the solvent—which has been applied primarily to extraction of vegetable and fish oils. The extraction is carried out at specified conditions of temperature, pressure and propane ratio in a continuous operation by counter-current contact of the oil and liquid propane in the fractionating towers.

At relatively low temperatures, liquid propane is miscible in essentially all proportions with glyceride oils. As the temperature is increased, progressively increasing amounts of an oil phase are precipitated, with different constituents of the various oils coming out of solution at different temperatures.

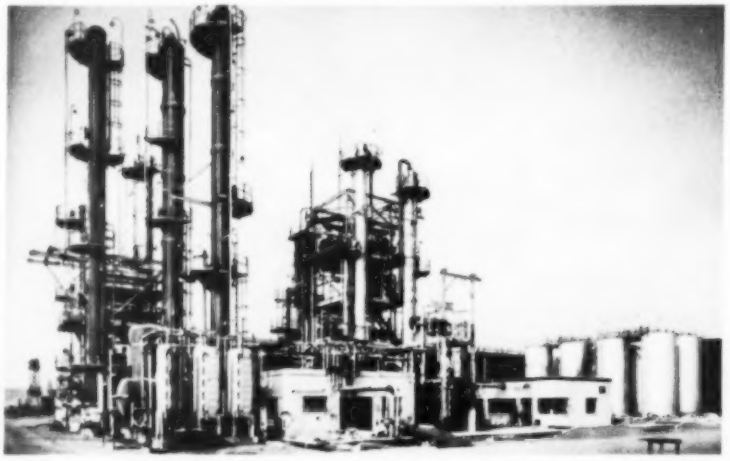
In the Solexol process, this property of propane forms the basis for the commercial separation of oils into their component parts. Separation is accomplished in the fractionating towers, while the remainder of the plant serves primarily to recover the propane from the oil fractions. Only small quantities of propane are required for make-up to maintain a constant inventory in the system.



Solexol pilot plant in Kellogg Petroleum and Chemical Research Laboratories.



Shown above is a typical Solexol plant. This one, located on the U. S. East Coast, is used for processing menhaden oil. The plant includes a propane destearinization unit for producing winterized oils.



The first phenol-from-cumene plant to employ the Hercules-Distillers process was this one located in Canada. (Details about the process may be found on the preceding page.)

For further information, technical data, etc., relating to chemical or petrochemical processes, write

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- ★ Glyceride Purification
- ★ Nitric Acid
- ★ Ammonium Nitrate
- ★ Ammonium Sulfate

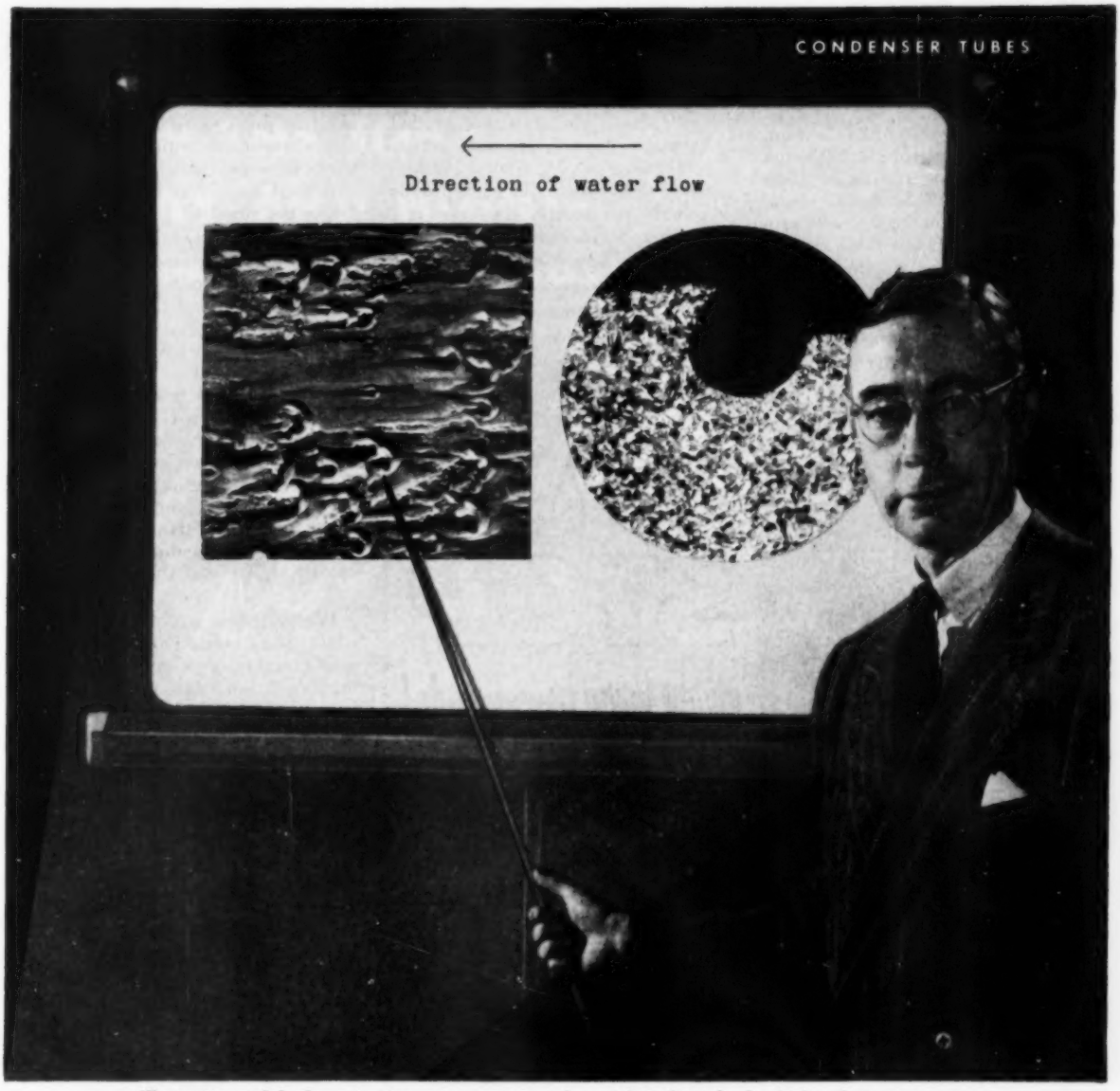

Illustration at left shows impingement corrosion of an Admiralty tube by high velocity sea water containing air bubbles. At right, longitudinal section through part of horseshoe-shaped pit is shown.

AIR BUBBLES: what causes them, how they affect condenser tubes

Before corrosion can occur, oxygen from the air dissolved in cooling waters must be present. But normally its presence doesn't cause *rapid* corrosion of condenser tubes.

What can cause rapid corrosion is air in the form of bubbles where turbulent flow is present. Whirlpools in the intake tunnel, leaky packing glands on pumps and at projections in injection pipes or water boxes may produce air bubbles of harmful size. Any condition that will produce a negative pressure at some point along a tube, such as a long outlet leg from a condenser, can cause air bubbles. Local pitting may then occur rapidly.

Air bubbles are only one factor affecting tube life. Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers," discusses *all* the important operational factors, and gives much other useful information. And, of course, our Technical Department stands ready to assist you in the selection of tube alloys from our extensive line. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

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Tubes and Plates for Condensers and Heat Exchangers

Arsenical Admiralty-439; Ambraloy-927; Cupro Nickel, 30%-702; and other copper alloys.*
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of over-eager readjustments was accentuated by abnormally low consumption of gasoline in agriculture.

This inventory problem is now well on the way to solution through common-sense application of well-tried American methods. State regulatory bodies have cut back crude production. Scores of individual refiners making scores of individual decisions have tailored the runs in their own refineries to meet their own ideas of what is right for them and/or the industry. Refiners who have been importing part of their crude oil have contributed something to the solution of the problem to the extent that they have cut back imports and utilized domestic crude already above ground.

Naturally enough, separate actions of a number of "oil states" making separate decisions to cut back production looks disorderly. However, it is comforting to remember that the reason why the movement appears to be disorderly is because the state bodies do not *have* to march in lock step. They do not move with the awful grandeur of the bureaucracy of a super state. One state moves slower than another. Another state doesn't "cut deep enough" in the opinion of its peers. In our democracy and with our free press there is plenty of open and aboveboard criticism. If the laggards have any sensitivity at all, their ears must sometimes burn. Personally, I like the situation just the way it is.

And because our laws forbid private citizens from agreeing to or contracting to restrict production of anything, it naturally follows that the cut-backs in refining have also been disorderly. Each refiner cuts back when, if, and as he pleases. Here again, the free press and the oil man's penchant for individualistic self expression are helpful. A refiner who pretends not to understand the available supply statistics in the hope of making another nickel while his competitors take the rap can hear, without difficulty, exactly what others think of him. Personally, I like that that way, too.

While there is a natural tendency in a time of tension and discomfort to accuse others of wrongful and selfish motives, I don't think that the refining business is apt to be wrecked by the few who might be willing to do it with their eyes open. What worries me is whether enough attention is paid by the mass of well-meaning refiners to the danger signals that are available for all to interpret. Now that the winter months are the biggest in total petroleum consumption and now that natural gas and liquefied gas are such strong competitors for heating oil, climatic conditions and forcasts are all-important in interpreting future demand.

More Executives Paid On Basis of Pre-Tax Earnings

The earnings of an executive should not be wholly at the mercy of the tax collector.

This is the conclusion being reached by an increasing number of companies, according to a survey of the Executive Compensation Service of the American Management Association.

Putting it another way, the AMA group found that profits before rather than after taxes are regarded as a fairer, more accurate measure of executives' efforts and performances.

Based on an analysis of nearly 400 current incentive plans for executives, the report found that approximately 45 percent of the commercial and industrial firms throughout the U. S. now make use of incentive compensation for executives. ##

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giving away your liquids!

Install a Russco Micro-Plant or Super-Knockout

NOW you can hike profits on your gas distillate wells — large or small — with Russco's miniature gasoline plants. Designed to solve your particular problems, the Micro-Plant and Super-Knockout installations are fully automatic . . . require minimum operating attention . . . and can be economically moved from one lease to another.

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Whatever your present production, the Russco Super-Knockout (Low-Temperature Processer) or Micro-Plant (Larger Unit) will step up recovery enough to pay out quickly and give you an excellent profit increase.

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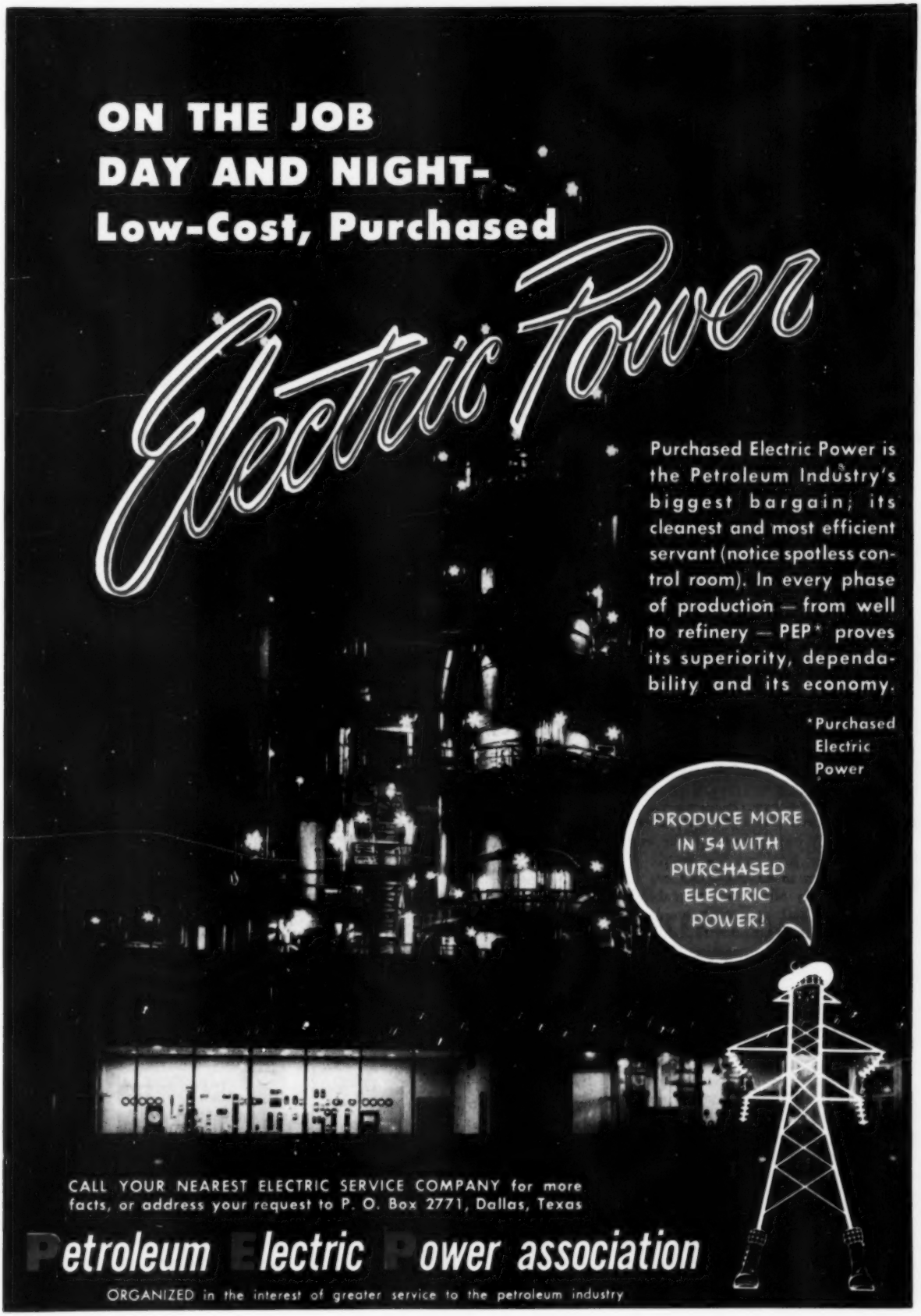
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Purchased Electric Power is the Petroleum Industry's biggest bargain; its cleanest and most efficient servant (notice spotless control room). In every phase of production — from well to refinery — PEP* proves its superiority, dependability and its economy.
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Where's the Fire?

Part VIII

H. B. Williams, Director, Safety and Fire Protection,
Pan American Refining Corporation,
Texas City, Texas

Vent Stack Fire

1. Make operational changes, particularly the following:
   (a) Open drain line from stack *to be sure all the oil is drained,* then
   (b) Cut steam to the stack.
   (c) If there is evidence that a relief valve has opened and will not reseat, proceed to take the equipment out of service and depressure.

2. If liquid hydrocarbon overflows the vent, apply high pressure water fog, working upward from the lowest flames.

3. Apply water spray to the entire structure enveloped in flame by placing monitors at points of advantage around the base of the structure to prevent heat damage to structural members.

Exchanger and Transfer Line Fires

1. In most cases exchanger and transfer line fires are the result of abrupt changes in temperature; so,
   (a) Make an effort to re-establish the normal operating temperature at the equipment.
   (b) If the normal operating temperature cannot be obtained, make efforts to reduce pressure on the equipment.

2. Apply steam, dry powder or carbon dioxide (preferably steam) to the point of leakage.

3. If the fire cannot be extinguished by use of portable equipment, apply high pressure water fog to the immediate area of the leak.

4. Protect structures and lines on which fire is impinging by applying spray from water nozzles on 2½-inch hose lines or monitors.

5. Apply foam, either mechanical or chemical, to trenches in which burning oil may accumulate, beginning at and covering the sewer drain to prevent fire entering the sewers.

6. Avoid working above sewer drains or near fire traps.

7. Maintain adequate drainage of fire area.

Electrical Machinery Fires

1. Operators should switch to spare machine, if possible; if this is not possible, operations should be adjusted or discontinued until equipment is operable.

2. Caution: *Do not use water or foam.*

3. De-energize the circuit if possible.

4. Apply carbon dioxide or dry powder to extinguish the fire.

Pump and Compressor Fires

1. Operators should switch immediately to spare machines, if possible; if this is not possible, operation should be adjusted to take the affected machine out of service and isolate it. Check if it is possible to drain or depressure the lines from a remote location.

2. Apply steam, carbon dioxide or dry powder from portable extinguishers to the leak. The following locations are equipped with CO_2 systems:
   (a) Thermal cracking unit No. 1, J-16 compressor room and J-3 pump room;
   (b) Treating plant;
   (c) Main pump house pump pits.

These systems all can be discharged manually, but some of them are controlled by automatic temperature rise detectors. The pressure of CO_2 in the discharge lines operates window and door closers permitting the space to be flooded with carbon dioxide. Personnel should not enter rooms into which CO_2 is being discharged as the gas, although not toxic, is suffocating in character.

3. If portable extinguishers and the fixed CO_2 systems are inadequate, blanket the fire area with water spray from 2½-inch hose lines and direct jets of high pressure water fog into the source of fuel until the operators have succeeded in stopping the flow of fuel.

4. Apply foam, either mechanical or chemical, to trenches in which burning oil may accumulate beginning at and covering the sewer drain to prevent fire entering the sewers.

5. Avoid working above sewer drains or near fire traps.

6. Maintain adequate drainage of fire area.

Trench and Pit Fires

1. Operators should check immediately and locate and stop the source of leakage into the trench or pit.

2. Apply steam, carbon dioxide or dry powder to the fire area. If this is not successful, apply foam, either mechanical or chemical, and if possible, begin at and cover the sewer drain.

3. Apply high pressure water fog or water spray to prevent damage to adjacent equipment.

4. Avoid overflowing trenches or pits with water as this may cause spread of the fire.

5. Avoid working above sewer drains or near fire traps.

Priceless Adjunct . . .

Prepared and proven plans for fire extinguishment are a priceless adjunct to plant protection.

Commencing last March *Petroleum* REFINER is presenting details from the fire fighting procedures of Pan American Refining Corporation, Texas City, Texas.

Part V is presented herewith. The series will continue.

Demonstration shows Rockwood FogFOAM SPOT Protection extinguishing gasoline fire.

How to quench a sudden flareup

Don't give danger "spots" a chance to wreck you! Give them the kind of coverage shown in the demonstration above. Here, a gasoline-filled pit was set on fire — and extinguished in a matter of seconds by a Rockwood *Spot Protection System* discharging Rockwood FogFOAM. This FogFOAM also provided fire protection to the surrounding area by covering the edges of the pit.

Rockwood FogFOAM is formed by mixing 3 parts Rockwood Double Strength FOAM with 97 parts water — then discharging it through specially engineered FogFOAM heads or nozzles. A protein type liquid, it is used in spot protection systems and also in fire hose lines by being discharged through the Rockwood Type SG-60 Nozzle or Type FFF Nozzle. The Type SG-60 Nozzle discharges high velocity FogFOAM, solid FOAM stream (through an Extension FOAM Shaper) and, when FOAM is shut off, high velocity WaterFOG, low velocity WaterFOG or straight water stream. For ¾", 1" and 1½" fire hose lines.

Put these firefighters to work for you.

ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Fire Losses

Rockwood Double Strength Foam clings to metal surfaces as an insulator, flows freely at sub-zero temperatures. Excellent for extinguishing fires in gasoline, benzol and other highly volatile flammable liquids as well as ordinary combustibles.

Rockwood Wet makes water go farther. One part of Wet mixed with 99 parts water, increases penetration and extinguishing action of water. A "must" for deep seated fires and where water is scarce. Helps reduce amount of time and manpower.

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Please send me your illustrated booklet on Rockwood fire-fighting products.

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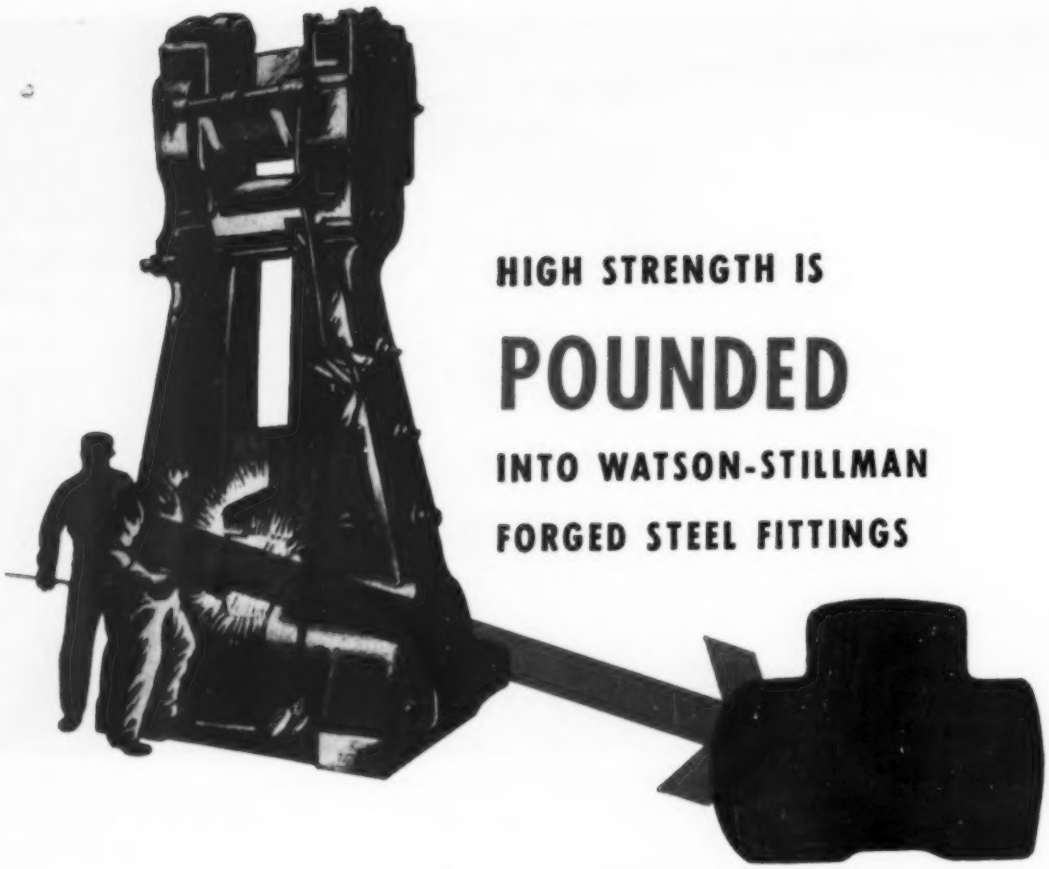

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Forged-Fiber Grain Structure Gives Added Protection Against Piping Failures

Watson-Stillman fittings are drop-forged. Hot steel billets are hammered and pounded and squeezed in hardened dies to form the solid fittings. This operation produces a dense, tough-fiber structure with exceptionally high tensile and impact strength... higher than can be obtained by other processes. W-S Forged Steel Fittings offer maximum resistance to pressure, heat, corrosion, shock and vibration... give you strong, tough, trouble-free joints.

Watson-Stillman Fittings are designed for high strength, too... with extra heavy sections where you need them. And they're precision machined to insure perfect alignment and tight joints.

For safe, reliable service... for greater protection against costly shutdowns... install Watson-Stillman Forged Steel Fittings. Available in SCREW-END and SOCKET-WELDING types in carbon, stainless and alloy steels.

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The Courts Say . . .

in recent insurance cases

Shelton

This column is to inform—not advise. It presents the current trend in legal thinking on insurance cases. The law varies from state to state and its application depends upon the facts of the particular case. Do not attempt to apply it without consulting your attorney.

Joseph M. Shelton, Attorney at Law, Dallas

That death was suicide, not accidental injury

EMPLOYE TOLD ANOTHER he was going home because he did not feel well. Another employe was removing acid from a tank and testified that the cover over tank was in place about 11:35 a.m. Employe was seen waiting for bus at about 12 noon. Shortly thereafter, the bus passed but employe was not there. At 12:40 his body was found in the acid tank. Employe was a large man; the opening to tank was so small that his arms would have had to be at his side to go through.

The court said it is a matter of common knowledge that one who fell accidentally would not hold his arms in such a position, but would in fact extend them to prevent the fall. Employe's background revealed psychotic disturbance. It was concluded that employe took his own life and compensation was denied for failure to show death resulted from performing a service growing out of or incidental to his employment.

—A. O. Smith Corp. v. Industrial Commission 59 N. W. 2nd. 471 (Sup. Ct. of Wis., 1953)

That fright from witnessing co-worker's fall was not covered

EMPLOYE AND CO-WORKER were on a movable scaffold suspended by cables when one end gave way, causing the co-worker to fall a considerable distance to his death. Employe held on and escaped injury other than a bruise and cable burn—both of which completely healed. Worker claimed that in addition to these injuries he suffered from severe fright which damaged his entire nervous system. He urged that this caused him to freeze at any unusual height and made him unable to perform all of the duties of a qualified iron worker. The Trial Court jury found for the employe.

The Texas Court of Civil Appeals said the employe's condition was functional rather than organic or cellular. The entire condition resulted from fright. The neurosis here did not arise from the injuries. Under the provisions of the Texas Workmen's Compensation law defining "injury" as "The terms 'injury' or 'personal injury' shall be construed to mean damage or harm to the physical structure of the body and such diseases or infection as naturally result therefrom," it would not be a compensable condition. The Trial Court's decision was reversed.

—American General Ins. Co. v. Bailey 268 S. W. 2nd 528 (Texas Civ. App.—Galveston, 1954)

"The Courts Say," a column which many readers have found interesting and valuable, appears from time to time in this section of Petroleum REFINER.

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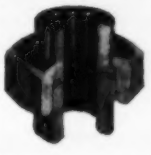
Standard & Double Extra Heavy
UNIONS
Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".



ORIFICE UNIONS
With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS
With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

Standard & Double Extra Heavy
LUG NUT UNIONS
Hammer-type for quick opening and quick closing.

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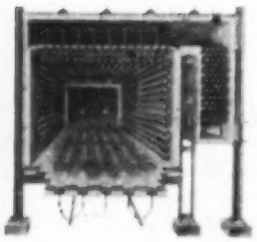
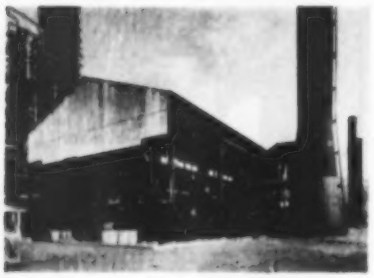
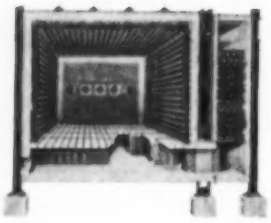
LUMMUS

OIL HEATER DIVISION
385 Madison Avenue, New York 17, N. Y.

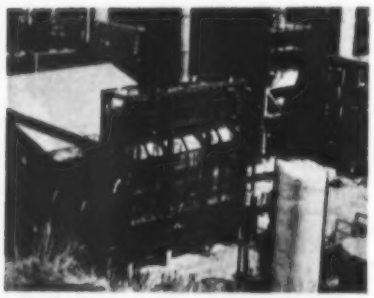


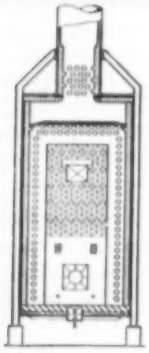
Lummus Standard Oil Heaters are made in two basic types. The up-take heater, illustrated at the left, conducts the products of combustion upward from the entire heating chamber at low and uniform levels of velocity.





The down-take heater, illustrated at the left, is suitable for service where products of combustion would contain corrosive elements or solid matter. It draws hot gases downward from the combustion chamber through the diffusion baffles. Both types of Lummus Standard Heaters are adaptable for multi-coil or multi-stage heating.





The Economy Heater, illustrated at the left, finds wide application in smaller refineries where the investment necessary for extensive maintenance platforms and roofing is not justified. The flexibility and variety of capacities available with multi-coil and multi-stage settings can be obtained with Lummus-Built Heaters in the same manner as with the larger Standard units.

Lummus Standard Oil Heaters and Lummus-Built Heaters are the answer to the vital problem of supplying process heat in any required amount for petroleum refineries, chemical and petro-chemical plants. Single Lummus Heaters are operating at continuous heat absorptions ranging from 100,000 to 300,000,000 BTU per hour. Lummus has designed and installed heaters for use with every major process.

BRANCH OFFICES — Houston: 2707 Weslayan Rd., Houston 6, Texas • England: The Lummus Co., Ltd., 80 Regent St., London W1, England • France: Societe Francaise des Techniques Lummus, 39 Rue Cambon, Paris 1er, France

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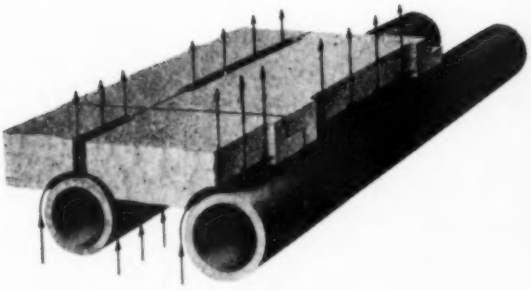
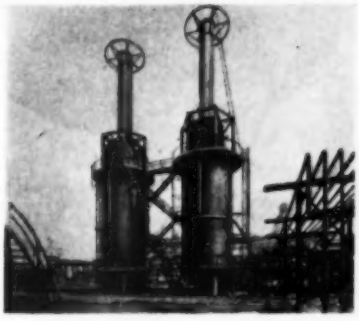
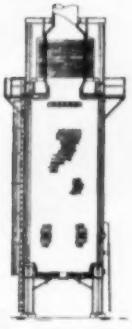


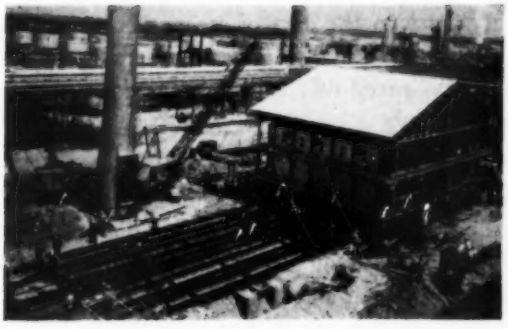
The patented gas diffusion baffle arrangement shown at the left is characteristic of Lummus furnaces. This arrangement creates a draft resistance or dampering effect which assures uniform evacuation of the products of combustion over the entire ceiling area of the combustion chamber.

Benefits obtained by the use of the slotted refractory baffle tile include high velocity gas flow over the shielded upper row of roof tubes—with consequent high convection heat pick-up—and re-radiated heat from the under side of the tile to the upper side of the bottom row of roof tubes.





Lummus-Built Heaters incorporate the same material, mechanical and operating advantages of the Lummus Standard Oil Heaters but are built along the more simplified and economical lines possible with their smaller size. The Lummus Vertical Tube Heater, illustrated at the left, for milder heat requirements, is especially designed for limited space installation.



The portable heater, left, was built for Magnolia in record time—a mere six weeks downtime compared with the usual five months. It is the height of flexibility and is a smooth-running 100,000,000 BTU per hour heater handling 36,000 B/D of charge stocks—an increase of several thousand barrels over the heater it replaced.

The heaters described above are, of course, Lummus designed. Lummus also has built and will build for you, if requested, counter-parts of all popular types of furnaces used in the petroleum, chemical and petro-chemical industries. Lummus can also build to your specifications any type of specialty heater that a particular production problem calls for. Lummus' 50 years of experience in constructing petroleum and chemical plants lies behind the work of the Oil Heater Division, providing the knowledge necessary to do any job requested by a customer—and to do it right.

BRANCH OFFICES — Chicago: 600 South Michigan Ave., Chicago 5, Illinois • Venezuela: Compania Anonima Venezolana Lummus, Edificio "Las Grandillas", Esquina Las Gradillas, Caracas, Venezuela • Canada: 455 Craig St. West, Montreal

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How far *was* Thirty Paces?

NOBODY knows, exactly. Back in the days of meetings on the "field of honor" neither the distances nor the weapons were very accurate. Land and buildings were sometimes "paced off" and even some phases of engineering followed the rule of thumb.

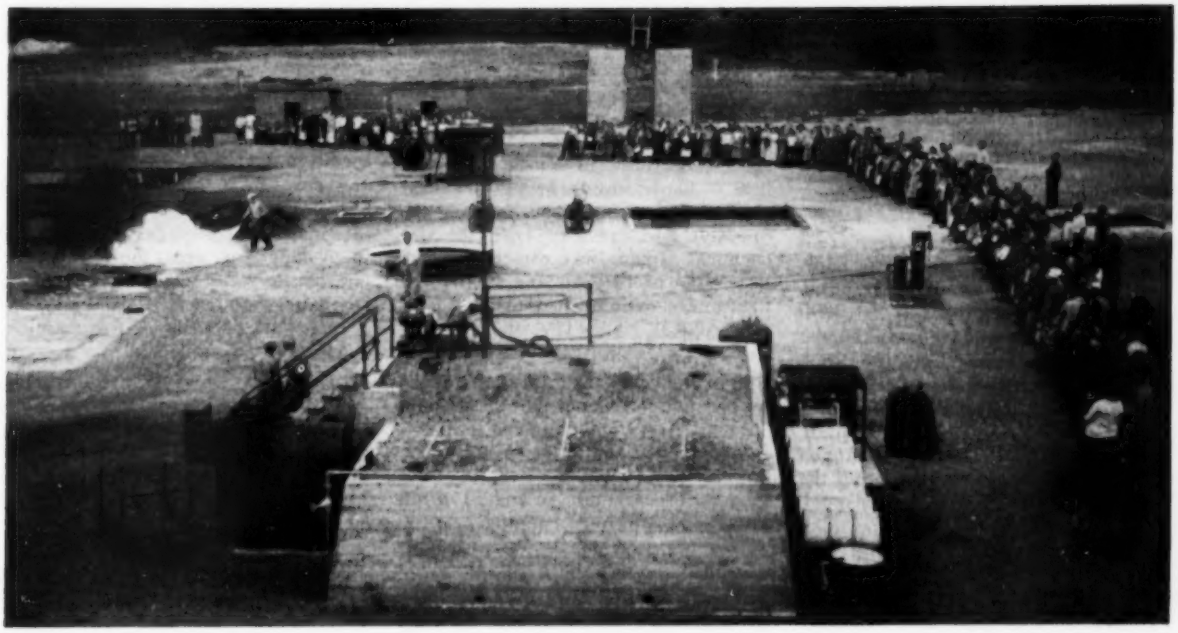
In the 49 years since Arthur G. McKee & Company was founded, *accuracy* has been the outstanding characteristic of our activities. Not just accuracy in measuring feet and inches but accuracy in determining the correct design for your plant—accuracy in its engineering and construction, accuracy in the selection and installation of equipment and controls.

The McKee organization makes a scientific approach to the problem of designing and constructing your new plant to earn a profit for you.

McKee Engineering Services

Arthur G. McKee & Company • Engineers and Contractors

Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York • Tulsa, Oklahoma • Union, N. J. • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 350 Bay St., Toronto



A small fire on the test field at Marinette is extinguished at a training demonstration. The structure in the foreground is a concrete abutment housing storage tanks for the fuel used during the fire schools.

They Graduate Fire Fighters

Industry employes receive intensive training at unique schools dedicated to improved protection against fire.

LAST WINTER gas blew out of an oil well near Ponca City, Okla., and caught fire from the exhaust of a diesel engine. Flames shot high into the air, fed by gas flowing at the rate of a million cubic feet per day. Forty hours and $40,000 later, it was put out in five seconds by one man.

Floyd Timmons of the Continental Oil Company refinery in Ponca City is a graduate of a unique fire training school conducted by Ansul Chemical Company of Marinette, Wis. He and his boss, Biff Hansen, were called to the fire after it had burned for 40 hours. From their Ansul training, they judged it would require one 30-pound extinguisher. As Timmons moved in, he was waved back by firemen who had been fighting the blaze for two days with foam, water fog and mud. But Timmons hit the flames at just the right spot and the fire was out five seconds later.

Hansen and Timmons attended the Ansul fire school in Kansas City, modeled after the school conducted at the company's headquarters in Marinette since 1940. The school was started when Ansul was pioneering in the use of dry chemical fire extinguishers. Company salesmen had to know how the extinguishers worked. Pretty soon the school had courses for the employes of Ansul customers and distributors. Lately the school's graduates have included fire engineers, safety directors, fire chiefs, industrial engineers and fire-fighting teams from the armed services.

Courses at the school vary in length. There is one for Ansul salesmen which takes three to four months. They learn how to fight fires, how to stage demonstrations and survey plants for fire hazards. Employes of Ansul's distributors get a streamlined version of this course in 10 days.

Three-Day Course—The course is telescoped into three days for other specialists who want to study Ansul's methods of fire protection. For instance, 33 plant managers, safety directors, and fire inspectors from the Ohio Oil Company recently came from all parts of the U. S. to attend a school conducted especially for them. Although it was the first time Ansul had ever conducted a school for only one company, it was typical of the other customer training schools in its advanced approach to fire fighting. Director Frank Hruska and his staff know their students have had years of experience in safety and fire protection. The school is conducted in an atmosphere of informal give and take where questions and discussion are welcomed. The trainees are encouraged to ask for special fires which will give them experience in problems of their individual plants. For Ohio Oil, Ansul brought in 2500 gallons of crude with approximately the same mixture as the company's product. Various fires were staged with this fuel to bring the instruction as close to actual operating conditions as possible.

All the facilities of the test field were

used. These included storage tanks which hold 2000 gallons of gasoline and 1200 gallons of liquid propane; a blockhouse for interior fires, concrete slabs for large area fires, steel pans and pits where flammable liquids are burned, and pumps and piping which can duplicate pressure fire conditions.

During their six-month season from May through October, the test schools use about 35,000 gallons of gasoline, 10,000 gallons of propane, and 3000 gallons of drain oil. All told, 250,000 pounds of dry chemical are used each year for tests and demonstrations.

The first day for the Ohio Oil men started as all schools do with an intensive briefing on what would happen on the test field. After inspecting the equipment and the training manual, they saw two films and started on small spill fires on the test field. Spill fires consist of flammable liquid spilled on the ground and ignited. The fires are expanded in area and fought by sweeping the dry chemical stream across the fire starting at the front. As they get bigger, the fires are attacked from one side of the front edge and the chemical is whipped across from one side to the other. In another technique used on very large fires, two operators with extinguishers split the flames at the center of the front edge and move outward.

After lunch the men came back to put out gasoline pan fires. These were graduated in size, too. They demonstrated the need to knock down the heat of the fire by throwing up a heat shield of dry chemical between the operator and the fire. Then the dry chemical stream was directed at the near edge of the pan and finally the flames are extinguished at the pan's rear edge.

From time to time, the men recharged their own extinguishers for the sake of both efficiency and instruction.

Small fires, common in any industry, were demonstrated to the Ohio men on the first day. There were small blazes in a paint dip tank, in a half drum on a table, and on a hanging pail.

Fire protection through interior piped systems was also shown. Ansul demonstrates the results in local applications of a system, in total flooding and in a selector valve arrangement.

Second Day—The second day the oil company representatives watched training films and then put their knowledge into practice on the test field. After a movie on the operation and maintenance of larger wheeled equipment, they put out large spill and pit fires staged with crude.

After another film on liquefied gas fires, the men put out three types of pressure fires. They extinguished horizontal and vertical jets and then attacked an impinging jet fire where the burning propane spouts from a nozzle, hits a wall, and spatters. In spite of these dangerous fires, the test field is one of the safest places in the Ansul company. Not one serious injury has occurred in 14 years of fire training.

The Ohio men found out how to extinguish an elevated pan fire, too. With an extension on a regular extinguisher, called an applicator, the fire was put out easily. Hruska pointed out that the much publicized GM Livonia fire started on an elevated conveyor belt.

Flare-ups in materials such as wood, rubber and coal were simulated in a broken gas line fire. First a perforated pipe was covered with coal cinders, earth and wooden sticks. Propane which had seeped through the mound was ignited. The trainees found that the flames could be knocked down with a dry chemical extinguisher, but the mound kept flaming up because the materials smouldered. The only way to extinguish them was by using a combination of the dry chemical and water spray.

The second day ended with a fire in the blockhouse. The men must go through heat, smoke, fumes and bad ventilation to extinguish this fire.

On the last day the Ohio men started with another film on a school held for the Royal Canadian Air Force. Then they found some of the large obstacle spill fires which simulated crash fires. After another film on flammable liquid pressure fires, they attacked fires blazing from flanges in a piped system. One of the featured fires was staged by inserting a faulty gasket in an overhead flange.

The last fires on the schedule are the most spectacular ones. They must be extinguished with larger equipment such as the 150, 500 and 1000 pound stationary units and the fire-fighting jeeps and trucks. The biggest fires are set from a vertical gasoline jet which shoots 75 feet into the air and an 800-square-foot grease pit.

The session ended with a briefing in industrial safety and rescue. All 33 Ohio trainees then received their diplomas and the unique fire school ties. ##

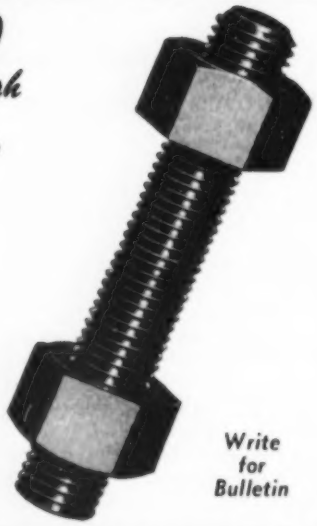
ALLOY STEEL BOLT STUDS

CENTERLESS GROUND

to Provide Smoothest Finish

At No Extra Cost . . .

- Made from heat-treated bars—(A.S.T.M. A193 Grade B-7).
- Threads *centerless-ground* to provide smooth finish unobtainable with most other production methods.
- Finish of KILBOURN ground threads greatly reduces seizing during assembly or disassembly.
- Widely used by oil refineries, chemical plants, power plants, pipe-line installations.



Write for Bulletin

KILBOURN Engineering Company, Inc.

5102 N. 35th St., Milwaukee 9, Wis.

STUDS • THREADED BARS • STILL SCREWS • STAINLESS STUDS AND NUTS

What Suppliers Are Doing . . .

Plunkett Allen Tunno Ross Overstreet Steinbuch Jones Gardner Richmond

H. B. Plunkett, who has been with **A. P. Green Fire Brick Company** over 35 years, has been elected executive vice president of the company. In recent years he has served as vice president and manager of domestic and Canadian affiliate companies. He is presently serving as chairman of the Mellon Institute Committee which controls the research program of the Refractories Institute.

R. W. Allen, formerly district manager of the Cleveland office of **Fritz W. Glitsch & Sons,** Dallas, has been moved to Houston to open the company's new office.

Julian J. Tunno, formerly Tulsa district manager of Fritz W. Glitsch, has been promoted to head the Cleveland office.

Bryan A. Ross, who has been assistant to R. W. Fowler, general manager of Fritz W. Glitsch, at Dallas, has been appointed district manager in the Tulsa office.

George W. Overstreet, formerly plant sales manager in the Decatur, Ala., mill of **Wolverine Tube,** Division of Calumet & Hecla, Inc., has been appointed sales representative in North and South Carolina and portions of Tennessee and Georgia.

Marvin L. Steinbuch, a member of the Metallurgical Research & Testing division of **The Lunkenheimer Company** since 1947, has been appointed chief metallurgist and research director. He succeeds John W. Bolton, who has retired after directing the company's Metallurgical Research and Testing division for the past 27 years.

Shelby Jones, head of Shelby Jones Company, has received the appointment for his company as exclusive sales representative for **Hamer Valves, Inc.,** in the eastern Pennsylvania, Delaware and southern New Jersey territories.

Karl A. Gardner, chief engineer of **The Griscom-Russell Company,** has been appointed chairman of the Technical Committee of The Tubular Exchanger Manufacturers Association, succeeding the retiring Sigmund Kopp.

John P. Richmond, formerly comptroller, has been elected vice president in charge of finance of **ACF Industries, Inc.** He succeeds James F. Clark, who was recently elected president. Other ACF changes: Paul M. Anderson, assistant comptroller since May, 1948, has been appointed assistant vice president; Walter J. Conaty, manager of accounting since 1951, has been elected comptroller, succeeding Richmond; David Ohler has become assistant treasurer, and Frank F. Cleminshaw and John W. Hubbard have been named assistant comptrollers.

Kaiser Opens New Office

A new sales office has been established by Kaiser Steel Corporation at

Oakite Products Opens Doors Of New, Expanded Laboratories

The new and expanded laboratories of Oakite Products, Inc., in New York, were officially opened last month with a ceremony highlighted by an "extensive look into the future of industrial cleaning materials and methods." The new facilities will be devoted to research and product development in chemical cleaning.

The laboratory, which covers 30,000 square feet on a single floor, is subdivided into three major sections—product development, customer service and engineering. A complete pilot plant is planned for the small scale manufacture of detergents and solvents prior to field testing.

Panellit, Taller & Cooper Join in Data-Reduction Work

The affiliation of Panellit, Inc. Skokie, Ill., with Taller & Cooper, Inc., Brooklyn, has been announced by the two companies. The announcement was made in connection with the International Instrument Exposition held in Philadelphia.

Under the agreement the new Tal-Cooper division of Panellit, Inc., will handle marketing and application engineering of Taller & Cooper products employed in the growing data-reduction field. The combination of the companies' manufacturing and engineering facilities will permit Panellit to cover the full scope of data-reduction and automatic process logging.

Here's something

NEW

in

straight-form thermometers

THEY OFFER THESE OUTSTANDING PLUS FEATURES:

DURABILITY—All parts of the new Rochester straight-form thermometers (except crystal) are of corrosion-resistant stainless steel. All are fused into a single unit by an exclusive welding process. Hermetic sealing assures easy reading of dial under any operating condition. No clouding.

EXTERNAL RECALIBRATION—Only Rochester thermometers can be recalibrated externally. A screw adjustment permits you to restore accuracy even if you knock the thermometer out of adjustment with a hard blow.

SELECT YOUR STEM POSITION—This thermometer is ordinarily supplied with the stem located at the bottom. However, it can be placed at the location you desire around the entire dial circumference. Available in stem lengths from 2½ to 48 in. Send for further information today. Write: Rochester Manufacturing Company, Inc., 38 Rockwood Street, Rochester 10, N. Y.

Rochester Manufacturing Company, Inc.
38 Rockwood St., Rochester 10, N. Y.

DIAL THERMOMETERS GAUGES AMMETERS

ROCHESTER GAUGES DEPENDABLE ACCURACY

For more data on advertised products, use Readers' Service Cards, last page

NOW! AVAILABLE
A FULL LINE OF SMALL GATE VALVES

Fig. No. 695

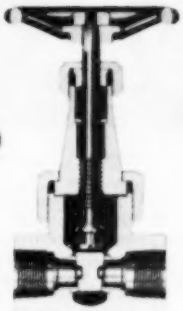


Fig. No. 65

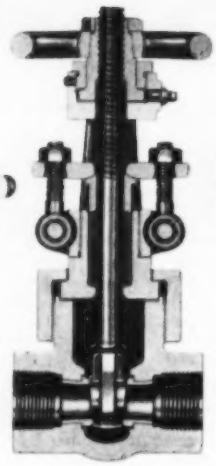


Fig. No. 55

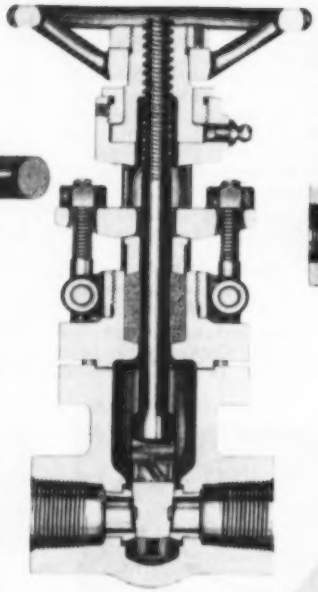


Fig. No. 595

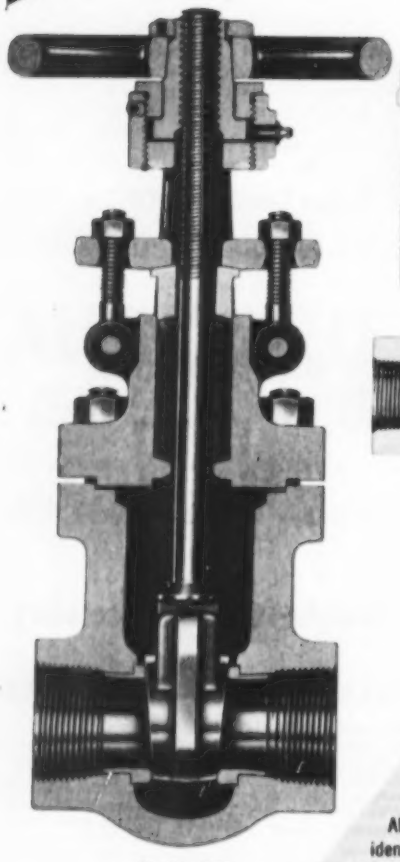


Fig. No. 3651

A SIZE, TYPE AND PRICE TO MEET EVERY REQUIREMENT

Now Pacific can offer the widest choice of selection of small 600 lb. Gate Valves,ever offered by any one manufacturer . . . a valve to suit every engineering problem or meet the tightest cost budget. Previously such selection could only be obtained from several suppliers. Available NOW from warehouse stocks, Pacific can supply five types of these valves, all with screwed ends: (1) Fig. No. 3651, Outside Screw and Yoke, Bolted Bonnet. This is the premium valve, available in a wide choice of Trim materials and recommended where a full port diameter is considered necessary; (2) Fig. No. 595, O. S. & Y., Bolted Bonnet. These valves are competitively priced, sturdy and compact, to meet tight cost budgets and for use where a full port opening is not a necessity; (3) Fig. No. 55, O. S. & Y., Union Bonnet. A comparable valve with Fig. No. 595 for those that prefer the compactness and dismounting features of the Union type Body-Bonnet connection; (4) Fig. No. 65, Inside Screw, Union Bonnet. A low cost compact valve for use where size, weight and cost are of the prime importance, also where the inside screw construction is acceptable and where a full opening port is not required; (5) Fig. No. 695, Inside Screw, Bolted Bonnet. A competitively priced line, comparable to Fig. No. 65 costwise but offering the advantages of the bolted on Bonnet assembly.

All five of these valves, regardless of choice are first quality valves, manufactured and tested to identical high standards and of fine materials proven best suited by years of actual experience.

Write or phone your nearest Pacific Valves representative for more detailed particulars including sizes, trim materials etc., and select for yourself the valve exactly suited to your job.

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

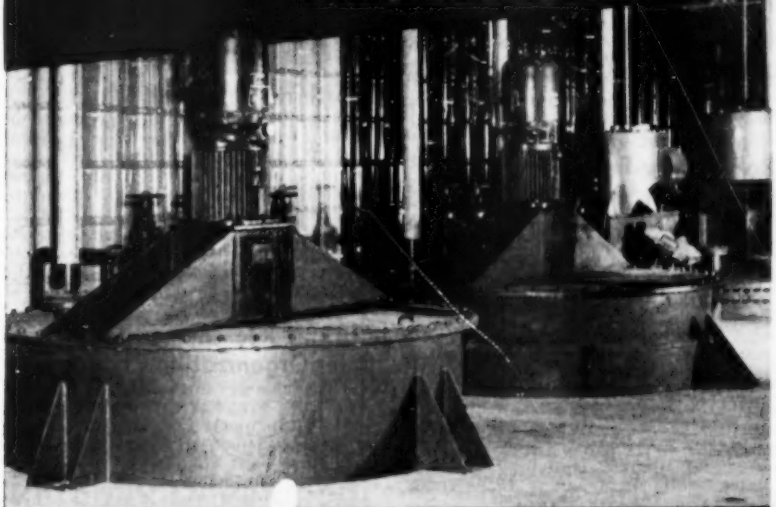
PACIFIC VALVES, INC.

3201 WALNUT AVENUE • LONG BEACH 7, CALIFORNIA

Telephones: Long Beach 40-5451; Los Angeles NEvada 6-2325

"Earning A Good Name In Every Industry"

Versatile Favorites in
PETROLEUM PRODUCTS PROCESSING



PATTERSON
SATISFACTORY
Kettles

Patterson Process Kettles are supplied in a wide range of size for every petroleum processing need —single or double motion drives— any desired internal or jacket pressure. Let us consult on your needs!

The Patterson Foundry and Machine Company
East Liverpool, Ohio, U. S. A.
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The Patterson Foundry and Machine Company, (Canada) Limited
Toronto, Canada
MONTREAL

Suppliers . . .

Phoenix, Ariz. John C. Mackey, formerly sales representative in the company's Southern district sales office in Los Angeles, will be the Kaiser Steel sales representative at Phoenix, with offices in the Bank of Douglas Building.

Orbit Makes Staff Changes In Texas and Oklahoma Sales

Bowling

Lastrapes

In major changes in sales personnel at Orbit Valve Company, James P. Bowling has been transferred from Lafayette, La., to Dallas, Texas, and Gil Lastrapes, Jr., has been appointed to service the company's South Louisiana area.

Bowling will service North Texas, East Texas and Fort Worth as well as the local area in Dallas. Lastrapes will make his headquarters at Lafayette.

Fluor Buys Majority Interest In New York Engineering Firm

The Fluor Corporation, Ltd., Los Angeles, has purchased a majority interest in Singmaster & Breyer, Inc., of New York. Remaining stock interest in Singmaster & Breyer is owned by partners of the firm, which specializes in process engineering services for chemical and metallurgical industries.

Partners and staff members of the partnership will be officers of Singmaster & Breyer. Frank Breyer, senior partner and co-founder of the firm, will become a Fluor director. Although details of the merger were not disclosed, it was indicated that Fluor will control 55 percent of Singmaster & Breyer stock.

Chicago Bridge Has Changes

Personnel changes have been announced by Chicago Bridge & Iron Company. Fred L. Goldsby, general sales manager, has become a vice president of the company; Raymond A. Johrde has been transferred from the Los Angeles sales office to the Tulsa sales office and H. B. Funderburk to the Houston sales office from the Birmingham, Ala., plant. George E. Borst, who has been manager of the Philadelphia sales office, has been moved to manager of the New York sales office, and Lucian J. Harris, formerly of the Los Angeles sales office, has been appointed manager of the Philadelphia sales office.

National Distillers Moves

The executive offices of National Distillers Products Corporation have been moved from 120 Broadway to the new

For more data on advertised products, use Readers' Service Cards, last page.

Suppliers . . .

aluminum-clad National Distillers Building at 99 Park Avenue, New York. The move was made in stages begun three weeks ago.

National Can Appoints Two Executive Vice Presidents

Andrew M. Toft and Allen C. Staley, Jr., have been elected executive vice presidents of National Can Corporation.

Toft

Staley

Toft has been vice president of National Can and was formerly vice president and general manager of Cans, Inc., before its merger with National Can about a year and a half ago.

Staley was formerly assistant general manager of sales of American Can Company. For the past 17 years, interrupted only by military service, he had been active with the company in sales management in all three of its divisions.

Hagen and Maves Draw New Assignments at Honeywell

In personnel changes announced by Minneapolis-Honeywell Regulator Company, John H. Hagen has been appointed director of industrial relations for the Brown Instruments division, and George Maves has been promoted to manager of the firm's Pacific region, with headquarters in Los Angeles.

Hagen, who has 20 years service with the company, was formerly special assistant to the divisional president, Henry F. Dever.

Maves had been manager of the Boston sales office since 1948. In his new post, he succeeds Gavin S. Younkin, recently named general sales manager of the company. R. W. (Bob) Forster, who has been manager of the Buffalo, N. Y. sales office, has been named to succeed Maves as Boston manager.

Robertshaw-Fulton Starts On Modern $2 Million Plant

Ground has been broken at Milford, Conn., for a new $2 million plant of the Bridgeport Thermostat division of Robertshaw-Fulton Controls Company. Six miles from the heart of downtown Bridgeport, the modern plant will be nearly double the size of the present plant. The Milford plant will contain 180,000 square feet of floor space on 15 acres.

The new installation is part of an expansion at Robertshaw-Fulton which, since the first of the year, has added or is now adding facilities at Irwin and Indiana, Pa., Anaheim and Long Beach, Calif., and Toronto, Canada.

R. J. Cooper F. J. Whelan

Worthington Gives Plaque

R. J. Cooper, left, vice president of Bradford Supply Company, accepts from F. J. Whelan, vice president of Worthington Corporation, a bronze plaque given by Worthington to Bradford to commemorate the long association of the two concerns dating back to 1926. The presentation was made at a recent dinner attended by executives of the two organizations.

Carbide Reassigns Three in Sales Organization Changes

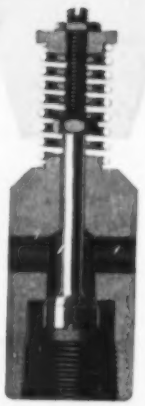
Three changes in the industrial chemicals sales organization of Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation, have been announced.

R. L. Duncan, who was district sales manager of the Detroit district, has been appointed Eastern division sales manager with headquarters in New York.

J. B. Harlow has been appointed district sales manager of the Detroit dis-

FOR VACUUM SERVICE

FOSTER Type V VACUUM BREAKERS AND REGULATORS



Foster makes a complete line of spring loaded automatic valves for use in vacuum service — with simple types for protection of stills, heater shells and similar equipment against collapse when cooling down, and more sensitive types for close control of vacuum in manifolds, air lines, and vapor lines for various processing requirements.

Like all Foster valves, they are designed and built for long life with minimum maintenance, and are easy to service when it is necessary. Ask for Bulletin V-101.

75 YEARS OF EXPERIENCE

FOSTER ENGINEERING COMPANY

835 LEHIGH AVENUE UNION, N. J.

AUTOMATIC VALVES • SAFETY VALVES • FLOW TUBES

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF PETROLEUM REFINER, published monthly at Houston, Texas, for October, 1954.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Ray L. Dudley, 3371 Chevy Chase, Houston, Texas; Editor, Robert J. Phillips, 3751 Colquitt, Houston, Texas; Managing Editor, Silas R. Ragsdale, 1636 North Blvd., Houston, Texas. Business Manager, A. L. Burns, No. 7 Chelsea Place, Houston, Texas.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) The Gulf Publishing Company, Houston, Texas; James Anderson, Houston, Texas; June Wooden Bliss, Houston, Texas; June Wooden Dudley Bliss—Trustee, Houston, Texas; A. L. Burns, Houston, Texas; Mrs. Grace C. Carter, Tulsa, Oklahoma; Mrs. Margaret D. Cashman, Houston, Texas; P. Stinson Dudley, Gainesville, Texas; Ray L. Dudley, Houston, Texas; Wm. G. Dudley, Houston, Texas; Wm. V. Gross, Fort Stockton, Texas; Carolyn Dodson Keeble, Pecos, Texas; Mrs. Anita S. Lane, Houston, Texas; Charles H. Lane, Houston, Texas; James William Nelson, Harlowton, Texas; Tom W. Nelson, Houston, Texas; J. Kent Ridley (Deceased), Houston, Texas; Walter Gage Sterling—Trustee, Houston, Texas; O. R. Waller, Chicago, Illinois; Mrs. Patricia McFarland Windham, Austin, Texas.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) M. D. Anderson Foundation, Houston, Texas.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

A. L. BURNS, Business Manager.

Sworn to and subscribed before me this 16th day of September, 1954.

P. J. AUCOIN,
(Seal) Notary Public in and for Harris County, Texas.
(My commission expires June 1, 1955.)

PETROLEUM CHEMICALS DIVISION

NEWS

October ★ One of a Series of Interest to the Petroleum Industry ★ 1954

No Country Like Our Country!

Each year, during Oil Progress Week, Americans can proudly celebrate the fact that in no other country are the people so well supplied with products and services that can only be made available through a great, progressive and competitive oil industry.

3 New Additives Recently Developed by Du Pont

Progress in the development of new petroleum additives has been rapid at Du Pont during the past year and a half.

The most recent of these is Lube Oil Additive 564. Now, for the first time in the history of motor oil additives, Lube Oil Additive 564 provides a viscosity index improver with effective detergent-dispersant action to overcome sludge problems caused by continuous low-duty stop-and-go engine operation. Its detergent action is also effective under medium and heavy-duty conditions. And Lube Oil Additive 564 is ashless, a unique quality in a detergent.

What's more, this new additive is highly effective in low concentrations and can, therefore, be used at reasonable cost. It is expected that it will prove especially valuable in motor oils used in urban car and delivery truck fleets, as well as in the average driver's car.

Another effective new additive recently announced by Du Pont is Estersil GT—a water-repellent silica grease thickener. This additive makes possible multi-purpose greases with unusually high shear and thermal stability.

Du Pont Fuel Oil Additive No. 2, announced only a little more than a year ago, has already proved its worth as a stabilizer and dispersant for both heating and diesel oils.

SERVICE!...

It has become a symbol of the Petroleum Industry . . . and it is the key policy of the Du Pont Petroleum Chemicals Division

In the language of the American motorist, "petroleum products" and "service" have become almost synonymous.

When the motorist needs gasoline, he looks for a *service* station. When he buys motor oil or chassis lubrication, he refers to his purchase as having his car "serviced." During the past half century, the tremendous growth of the petroleum industry has been built on *service* . . . and the public has benefited richly from it.

A UNIQUE SERVICE for refiners and marketers is the quarterly Du Pont Motor Gasoline Survey. It is based on hundreds of service station samples collected by Du Pont representatives every three months.

At Du Pont, we have designed our services in connection with additives to be outstanding, too . . . and many of these are the kind that stimulate your business at the service station and consumer levels.

Marketing Services

Du Pont Petroleum Chemicals Division services cover a wide range of oil company activities. In marketing, for example, the Du Pont services are designed to fit in with the individual company's own sales promotion programs . . . to help them get *extra* mileage out of their promotion investment.

The recent extensive survey of consumer gasoline buying habits is one example of a Du Pont service that can be equally valuable to every oil company. And the Du Pont brand name, lube oil, and chassis dynamometer presentations can be easily tailored to meet individual marketing requirements. In addition, Du Pont also supplies marketers with a wide variety of dealer-training aids.

Technical Services

As oil technology progresses, new technical problems have a way of constantly cropping up. Since the solution to technical problems generally comes easier and faster when extra information is available, Du Pont makes available a number of widely varied technical services to assist refiners.

For example, our five well-equipped regional laboratories, conveniently located near the major refining areas of the country, work exclusively on oil and automotive industry problems. And the Du Pont fleet of fuel test cars is often called in to help refiners solve

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED "Service"

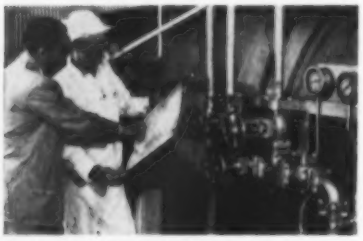
road performance problems. Another unique Du Pont service is the engineering of tetraethyl lead blending plant design and construction.

In addition, the Du Pont Company continuously carries on basic research of value to the petroleum industry . . . and publishes many of the results in technical papers for the benefit of the whole industry. Also, Du Pont technical representatives are always available for consultation on manufacturing problems.

Safety, too!

In spite of the many occupational hazards which refiners must face daily, the industry has established an admirably high safety record throughout the years.

To help you maintain this fine record, the Du Pont safety and medical



DU PONT REPRESENTATIVES work closely with refinery blending plant personnel on tetraethyl lead handling problems.

services include stand-by personnel for tank-cleaning operations. Also a variety of interesting talks as well as worker examinations by doctors specializing in tetraethyl lead hazards. In addition, aid is given in the design of special safe-handling apparatus for blending plants and, finally, a broad range of personnel-training aids is also available.

In Addition . . .

Du Pont offers many services of a general nature. The Quarterly Gasoline Quality Survey is one example. And to aid the industry in its over-all public relations activities, Du Pont has contributed the famous "Magic Barrel" show and a number of educational films such as, "Pipeline on Wheels," "It Never Rains Oil," and What Makes A Gasoline Good."

Are *you* taking full advantage of these helpful services? If not, you can easily request them through any of our regional offices listed below.

Still Rolling!...

"MAGIC BARREL" SHOW TELLS UNIQUE PUBLIC RELATIONS STORY TO MANY MILLIONS

Our modern petrochemical industry makes "Aladdin's Lamp" look like a piker.

And *millions* of Americans are becoming increasingly aware of this through seeing the Du Pont-designed "Magic Barrel," which is currently being presented by individual oil companies and the OIIC.

During the past year, the "Magic Barrel" has starred on more than 50 different television programs, playing to many million people. Approximately 300,000 have seen the show through lecture presentations to civic groups, service clubs, luncheon meetings, employee and customer gatherings.

Your future customers are learning more about the oil industry from it, too. By the end of this year, it is planned that the "Magic Barrel" will have been seen by every child in the City of New York school system. And it is also being shown to thousands of other school children and college students across the country.

To get the project rolling initially, Du Pont designed and supplied the original barrels, and furnished many of the oil-based products in the show. There are now 148 "Magic Barrels" on the road. Du Pont also helped in the training of the more than 600 oil industry employees who present the show.

Now—it's the "MAGIC SUITCASE"

The women, it seems, are not to be outdone when it comes to using ingenious products made from petrochemicals.

CONNIE MOON, originator of the "Magic Suitcase" and women's program director for the OIIC, is shown here demonstrating a dramatic dye-bath with oil-based fabrics and dyes.

The OIIC has come up with a new demonstration-lecture which combines entertainment with the story of oil in a woman's world. Called the "Magic Suitcase," the demonstration is built around a small suitcase containing 35 oil-based products. They range from shimmering fabrics to sunglasses, perfumes and lipsticks.

The speaker, moreover, appears before her audience "dressed in oil"—in clothes made of "Orlon" acrylic fiber, "Dacron" polyester fiber, nylon, or some other new fiber created with oil and modern chemical science.

During Oil Progress Week and throughout the coming year, the "Magic Suitcase" will be shown to women's clubs, PTA meetings, church and other group gatherings.

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Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • *Wilmington 98, Delaware*

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TULSA, OKLA.—1811 So. Baltimore Avenue	Phone Tulsa 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg.	Phone BLackstone 1151
LOS ANGELES, CALIF.—612 So. Flower St.	Phone MAdison 5-1691

IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division, 80 Richmond Street West, Toronto 1, Ontario
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

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A-8027

Printed in U. S. A.

Suppliers . . .

trict. He had been district sales manager of the Atlanta district.

G. E. Bernard has been appointed district sales manager of the Atlanta district. He had been assistant district sales manager of the San Francisco district.

Wolverine Tube Appoints Simcox Sales Representative

Harry L. Simcox has been appointed a sales representative in the East Central district with headquarters in Columbus, Ohio, for Wolverine Tube, Division of Calumet & Hecla, Inc.

Simcox

Simcox has been an office sales representative at Wolverine's general sales offices in Detroit since December, 1953. He will service industrial accounts only in southern Ohio and parts of Indiana and Kentucky.

Grant Gets New Honeywell Post

R. B. (Bob) Grant has been appointed Los Angeles branch manager for Minneapolis-Honeywell Regulator Company. Since 1949, he has been regional industrial manager for the Pacific region.

Allied Chemical Opens New Research Lab—

In this new research laboratory at Morris Township, N. J., the General Chemical division of Allied Chemical & Dye Corporation will expand the division's diversified research program in industrial, agricultural and fine chemicals. The three-story L-shaped building provides over 55,000 square feet of floor space, which accommodates more than 30 laboratories of various types, a technical library, and engineering research offices.

Hooker Buys Barge to Move Liquid Caustic Soda in Bulk

Hooker Electrochemical Company has purchased a barge, named "HECo I," for transporting liquid caustic soda in bulk to customers on the inland waterway system in the Chicago area.

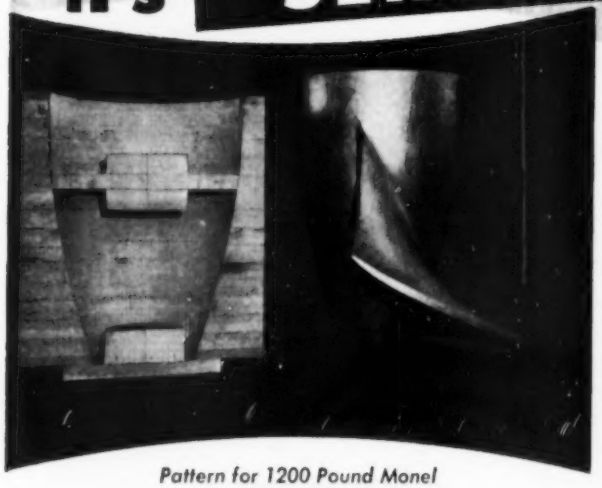
The barge was fabricated by Dravo Corporation, which installed the special equipment. The 175-foot barge, with a draft of seven feet nine inches, was designed for shipping on the Illinois Waterway and Mississippi River tributaries.

Dow Chemical Promotes Two in Plastics Production

Two production executives have been advanced to new positions in the Plastics Production department of The Dow Chemical Company.

Max Key, who has been in charge of the Saran-Polyvinyl Chloride section, has been promoted to the newly established position of assistant production manager in charge of the department's Midland production operations. In his new capacity, Key will have administrative responsibility for production in

It's "SERVICE" you want



Pattern for 1200 Pound Monel Impeller Casting

For your castings and matching requirements consult with our "SERVICE" Foundry Engineers. You'll find they will cheerfully work to give you a fine job. . . Service Foundry is a major installation with large capacity facilities for:

- **Carbon, Low Alloy & Stainless Steel Castings up to 11000 lbs.**
- **Grey Iron Castings up to 2000 lbs.**
- **Bronze and Non-Ferrous Castings up to 2000 lbs.**
- **Cut Gears up to 14'-6" Dia.—6" Pitch**
- **Heavy Industrial Machine Work on Castings, Shafting, etc.**

"Service" Engineers have had many years of on-the-job experience, and "SERVICE" will help you meet your schedules promptly. May we work with you?

"SERVICE" IS ESSENTIALLY IMPORTANT TO INDUSTRY AND IS TRADITIONAL WITH US.

SERVICE FOUNDRY a division of AVONDALE MARINE WAYS, Inc.

416 Erato Street, New Orleans, U. S. A. P. O. Box 1030, New Orleans, U. S. A.

Cable Address: "Serfdry"

Suppliers . . .

the Cellulose, Saran, Styron and Vinyl Toluene sections.

A. T. Maasberg, who has been in charge of the department's Cellulose Products section, has been advanced to the newly created position of technical director of the department. His new duties will include the general administration of research and development, cooperation with section superintendents on plastic process and product activities and general liaison work with other plastics groups.

New Coke Battery Operating

A new 76-oven, by-product coke battery has gone into operation at the Campbell Works of The Youngstown Sheet and Tube Company at Youngstown, Ohio. It has a daily capacity of 1250 tons of coke, or about 450,000 tons a year. The ovens have 730 cubic feet of capacity, about one-third larger than the Campbell plant's older ovens. The battery is over 350 feet long. New ovens have underjet firing.

Cooper Alloy Changes Name

Name of The Cooper Alloy Foundry Company has been changed to Cooper Alloy Corporation. Reason given for the change was that Cooper Alloy, longtime producer of stainless steel cast products, has been manufacturing special product lines for many years in addition to producing custom castings.

Smith to Head Operations of Donegal Division at Marietta

A new refinery steel castings division has been established at Marietta, Pa., by Donegal Manufacturing Corporation. Operations of the new division will be directed by Gerald C. Smith, of New York, newly elected Donegal vice president and general manager of the Refinery Fittings division. He was formerly sales and service representative for Key Company.

Smith

Merle E. Burkhart, of St. Louis, a former member of the consulting firm of K. P. Wesseling & Company, has also joined Donegal. He will direct design and engineering.

Beckman Sets Up Computers

A national network of analog computing and simulation facilities has been set up by the Berkeley division of Beckman Instruments, Inc. The facilities are staffed by independent organizations, equipped with computers and linked in a network to provide full interchange of experience and operational techniques. Facilities are located at: Richmond and Los Angeles, Calif.; Baton Rouge, La.; Birmingham, Ala.; Roseland, N. J.; and Arlington, Mass.

Ohio Injector Makes Shepard New General Sales Manager

Appointment of William G. Shepard to general sales manager for The Ohio Injector Company has been announced. He will supervise sales activities for the company's domestic and foreign sales.

Shepard

With The Ohio Injector Company since 1945, Shepard has been district sales representative, and has worked in the company's home office Sales department at Wadsworth, Ohio. He moves into his new post from the firm's Chicago office where he was division sales manager.

Warren Steam Pump Names Young to Sales Post

Frank Young has been appointed sales-service engineer for both the Marine and Industrial Sales departments of Warren Steam Pump Company, Inc., Warren, Mass. Prior to joining Warren Steam Pump Company recently, he was associated with Joseph C. Bogue, Belmont, Mass., consulting engineer.

Merger Announced

Merger of Nooter Corporation and Missouri Boiler and Sheet Iron Works has been announced. Missouri Boiler and

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MORE STORAGE IN LESS SPACE

Rigid frame buildings with *steel by Dollinger* give you more storage room. Greater usable height from the floor made possible by use of longer unsupported spans affords economy, too.

Your individual storage problems can be solved quickly and economically by consulting Dollinger—leaders in steel fabrication. Phone or write.

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Specializing in the non-ferrous metals in counts to 200 x 200 or 50 x 750 and widths up to 18" in all commercial weaves

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Wolverine Trufin*

TYPE S/T

Here's an efficient way to deliver a potent one-two punch to condenser tube problems. Specify Wolverine Trufin*—Type S/T.

Result—you boost condenser tube surface area—get *more* BTU's per foot of tube—increase operating efficiency—reduce operating costs.

Wolverine Trufin—Type S/T—is extended surface condenser tubing designed primarily for shell and tube heat exchangers. The O.D. of the plain ends is slightly larger than the O.D. of the fins. Because the fins are integral—actually part of the tube—they retain high efficiency despite high temperature, pressure or vibration.

Trufin is available in copper, copper-base alloys, aluminum, electric-welded steel and stainless steel. Where jobs call for prime surface tubing, you can select from Wolverine's three metals: copper (and its alloys), aluminum, or electric-welded steel.

Obtain all of your condenser tube requirements from one source. No matter what they are, finned condenser tubing, plain condenser tubing or U-Bend (plain or finned condenser tubing) Wolverine has a wide range of sizes and alloys.

If you need help, tube technicians from Wolverine's Field Engineering Service are more than eager to be of service. Write today for Wolverine's new booklet describing how to reduce your heat exchanger cost with Trufin Type S/T condenser tubing. It's packed with data on Trufin economies. WOLVERINE TUBE, Division of Calumet & Hecla, Inc., 1437 Central Avenue, Detroit 9, Michigan.

*REG. U.S. PAT. OFF.

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.
Manufacturers of Quality-Controlled Tubing

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.
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EXPERIENCED IN THE FOLLOWING:

WORKING WITH our process engineers on all projects, both plant and unit design, are staff engineers well versed in specialized phases of engineering such as electrical, mechanical, steam, power, hydraulic and structural.

Perhaps our service will be just what you are looking for—a service responsible for the design and construction of your complete plant or unit project. What you are looking for in size... integrated experiences... flexibility... and broad knowledge of processing!

Photograph shows recently completed naphthalene unit

Engineering

Design and Construction of Process Plants

●

Design and Construction of Process Units

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Process Evaluations

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Economic Studies

Organic Chemical Synthesis

Inorganic Chemical Processing

Catalytic Operations

Solvent purification

Separation and Refining of Organic Chemical Mixtures by conventional, azeotropic and extractive distillation, liquid-liquid extraction, crystallization

Petroleum Processing:
Topping and Vacuum Distillation
Lube Oil Units

Coal Tar Distillation

Gas and Vapor Recovery

Pharmaceuticals

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POSITIVE CORROSION PROTECTION

Capital investment losses of costly equipment can now be controlled by the newly perfected Lambco Chemical Proof Enamel.

This new and amazing coating resists the destructive effects of nitric acid, picric acid, hydrochloric acid, brines, alkalies, refinery crudes, detergents and even a 50% solution of sulphuric acid.

Brushes or Sprays . . . Lambco Chemical Proof Enamel can be brushed or sprayed. Dries dust-free in 30 minutes and can be re-coated in 4 to 6 hours. Lambco Chemical Proof Enamel is easily applied on new or previously coated surfaces.

A Lambert Corrosion Engineer is as close as your telephone . . . just call our nearest office collect.

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worth repeating...

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ONCE A WEEK
of
SAND-BANUM
Pure Colloidal Concentrate

Remove and Prevent Boiler Scale and Corrosion

For ALL Radiator Cooling Systems
Diesel Rigs and Trucks
Use
SAND-BANUM SPECIAL
in the Handy Tablets
Stocked by Leading Supply Houses

AMERICAN SAND-BANUM CO.
Established 1926
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New York 20, N.Y.

Suppliers . . .

Sheet Iron will become a division of the Nooter Corporation. There will be no change in management.

Blaw-Knox Division Names New Sales Promotion Manager

Marvin M. Ramer has been appointed manager of sales promotion for the Chemical Plants Division of Blaw-Knox Company. He was formerly contact manager of the division's Western headquarters at Tulsa.

Ramer

Prior to joining Blaw-Knox five years ago, Ramer held several managerial and technical positions in the chemical industry.

A registered professional engineer in New Jersey and Oklahoma, he is a member of the National Society of Professional Engineers. While in Tulsa, he was section chairman of the American Institute of Chemical Engineers.

Company Changes—

V. W. Aubel, Jr., has been appointed manager of the Philadelphia sales branch of the Solvay Process Division of **Allied Chemical & Dye Corporation,** succeeding the late C. M. Peterson. Aubel was formerly manager of the Calcium Chloride Sales department . . . **Glen A. Stetson,** assistant to the general manager of the Transportation Sales division of **The Sherwin-Williams Company** since 1950, has been named transportation sales and service representative for the company. He succeeds Harry M. Faber, who is retiring after 47 years with Sherwin-Williams.

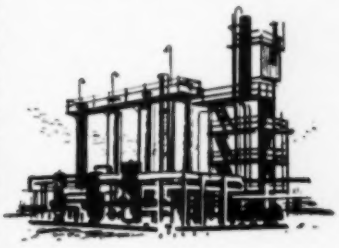
Charles W. Bowden, Jr., formerly chemical industry sales manager for the Industrial division of **Minneapolis-Honeywell Regulator Company,** has become market extension manager of the division, succeeding D. M. Considine, resigned . . . **George Rieger** has been named to lead and coordinate market research activities of the recently formed Commercial Development department of **Diamond Alkali Company.** He was formerly assistant manager of the Sales Research division of Hercules Powder Company . . . **Dr. J. C. Pullman,** formerly assistant to the manager of the New Product Development department of **American Cyanimid Company,** has been named manager of technical service of the company's Petrochemical department.

Richard L. Hasselquist has been appointed factory manager of **A. Y. McDonald Mfg. Company.** He formerly had been production manager and superintendent of military equipment contracts at John Deere Company . . . **George F. Klein, Jr.,** formerly chief engineer of Spencer Chemical Company, has become manager of the Process Engineering department of **Catalytic Construction Company.**

Otto H. York Company has relocated

problem

To meet ethylene consumer demand for a product that is essentially free of acetylene.



solution

GIRDLER developed catalysts to selectively hydrogenate the acetylene in the presence of the ethylene. Acetylene content was cut more than 99% giving consumers what they wanted:

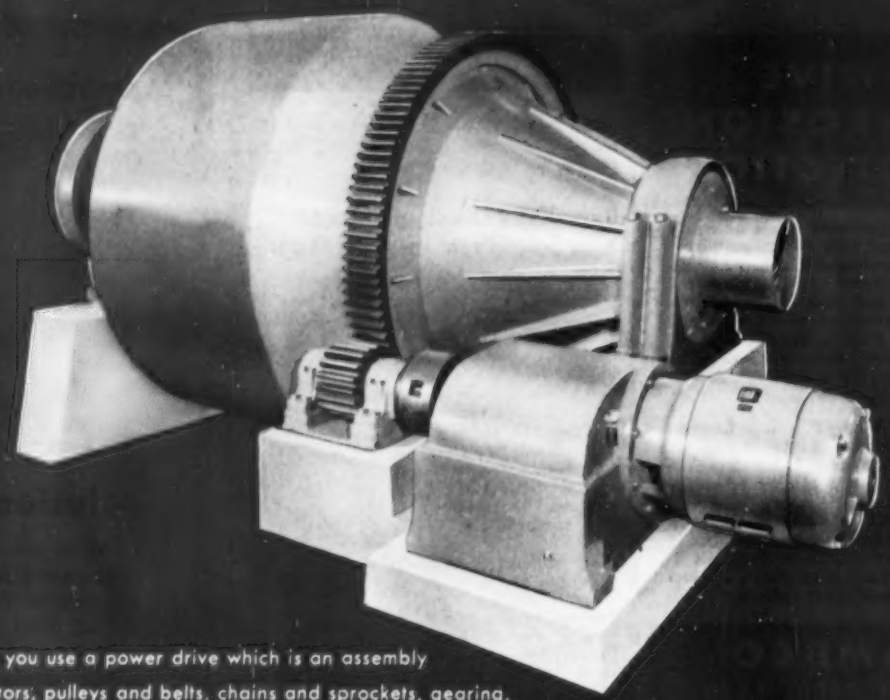
Ethylene with less than 50ppm of Acetylene

Girdler will gladly help solve *your* catalyst problems.

FOR
Catalysts
WRITE...

The
GIRDLER
Company
A DIVISION OF
NATIONAL CYLINDER GAS COMPANY
Gas Processes Division
LOUISVILLE 1, KENTUCKY
NEW YORK • TULSA • SAN FRANCISCO

For more data on advertised products, use Readers' Service Cards, last page.



When you use a power drive which is an assembly of motors, pulleys and belts, chains and sprockets, gearing, speed reducers, etc., you waste time and money in purchasing, handling and assembling these various units into the final drive.

Master power drives designed as complete units with component parts matching size for size and rating for rating offer you considerable saving in space and money . . . especially in the larger sized units.

So don't put up with "make-shift" assemblies when you can select from Master's broad line, standard units which easily combine to give you the RIGHT horsepower, the RIGHT shaft speed, the RIGHT features in one compact unit that you can use RIGHT where you want it.

Use the RIGHT power drive to increase salability of your motor driven products . . . improve the economy, safety, and productivity of your plant equipment. That's the horsesense way to use horsepower.

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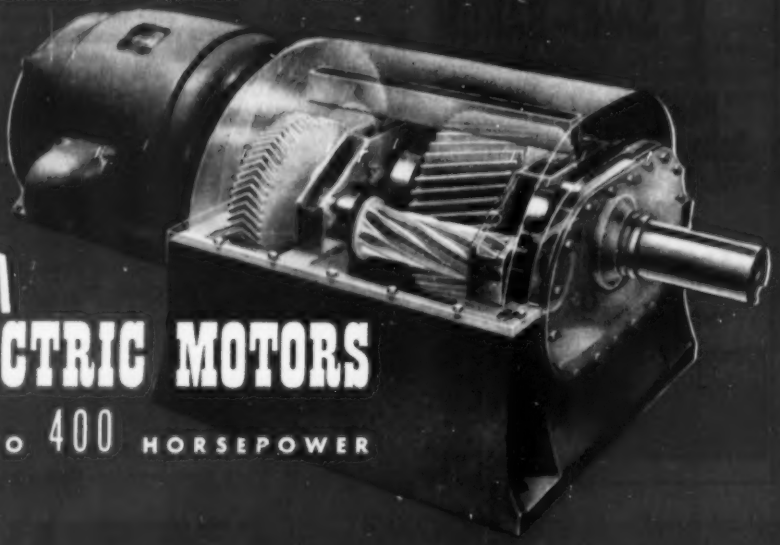
best for the BIG ones too



MASTER

ELECTRIC MOTORS

1/8 TO 400 HORSEPOWER

Suppliers . . .

its offices and plants to new and larger quarters at 6 Central Avenue, West Orange, N. J. . . . **Scoville Manufacturing Company** has moved its Los Angeles warehouse and sales offices to new and larger quarters at 6464 East Flotilla Street . . . **Durametallic Corporation** has appointed **General Sales Inc.**, Amarillo, Texas, as sales and service representatives . . . **Owens-Corning Fiberglas Corporation** has completed its Kaylo distributor-contractor organization to serve 48 states, the District of Columbia and Alaska. Owens-Corning was appointed last year as national distributor of the heat insulations which are manufactured by Owens-Illinois Glass Company.

Tellepsen Petro-Chem Adds Wilde as Division Sales Head

Stafford H. Wilde has been appointed division sales manager of Tellepsen Petro-Chem Constructors, a division of Tellepsen Construction Company, of Houston.

Wilde

Wilde was formerly a vice president and director of Bellco Industrial Engineering Company, a firm which he organized in 1945. Prior to that he was associated with the Henry J. Kaiser Interests, working on such projects as Hoover Dam, Delaware Water Aquaduct for New York, and the U. S. Naval Air Station at Corpus Christi. At Bellco he was closely associated with the chemical and petroleum industries.

Pacific Valve Appoints Harmon Tulsa District Head

Appointment of Howard Harmon as district manager for its Mid-Continent area has been announced by Pacific Valves, Inc. Harmon will have headquarters in Tulsa.

Harmon

Harmon, well known in the petroleum and chemical industries, was recently secretary of the California Chapter of the American Association of Oil Well Drilling Contractors. Prior to this, he managed the New York office of Pacific Valves for many years. Harmon has first-hand knowledge of the valve industry and the valve user's problems.

Niagara Filters Adds to Sales

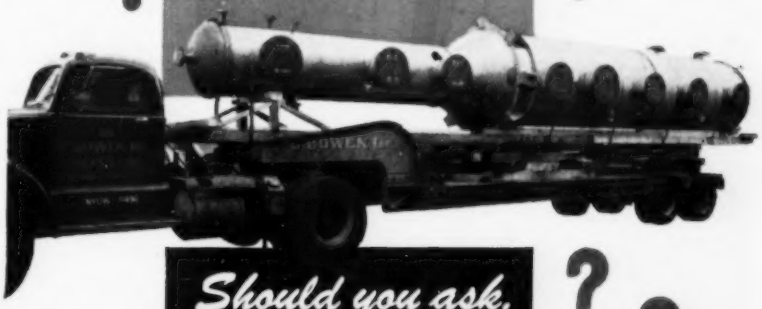
Several sales appointments for the Niagara Filters division of American Machine and Metals, Inc., have been announced.

John A. Meursinge, Los Angeles, and Allan Edwards, Inc., Tulsa, have been appointed sales representatives. James J. McHugh has been appointed sales representative for Niagara Filters division

THIS MONEL COLUMN Answers Two Questions

Should you ask,

"What kind of processing equipment do you make?," part of our answer would be to tell you about this column, an all-monel, one-piece unit.



Should you ask,

"Do you design to meet the customer's needs as well as fabricate to his specifications?," our answer would be, "Yes, we do both. We designed this column."

Our equipment design staff has an exceptionally broad understanding of processing and the part equipment plays in its many ramifications. Our shop men can point to many years of experience fabricating with all commercially used metals.

Thus, we can be of service in two ways:

1. Study your processing requirements and design the column, tower, tray, heat exchanger, retort or whatever equipment you require, check with your technical and operating men, then fabricate; or
2. Fabricate to your design specifications. In such cases, we always re-check dimensions, parts and choice of materials. Often, we have been able to suggest ways both to improve the design and to economize on fabrication.

This column comes under the first type of service. If either would fit into your equipment requirements, we'll be glad to discuss them with you.

Engineering and Manufacturing Process Equipment to Your Requirements

We have certain standardized specialties of our own design or which we licensed to manufacture and sell such as: sectional trays, sieve type trays, Socony-Vacuum UNIFLUX trays, Shell TURBOGRID tray; boiling caps, etc.; vapor compression stills; Badger Corrugated-Type Expansion Joints.

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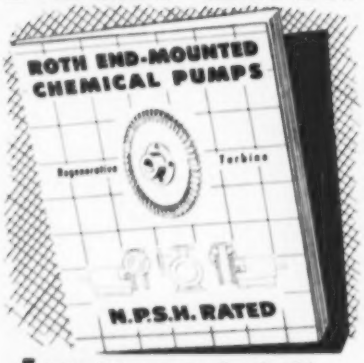
For more data on advertised products, use Readers' Service Cards, last page.

New, Technical PUMP DATA



FREE! 24 pages of valuable technical data including:

- An exhaustive study of the application of regenerative turbine pumps in chemical service.
- An original approach to NPSH together with full data on the use of this concept in selecting chemical pumps.
- A description and evaluation of various mechanical seals available in our turbine chemical pumps.
- Describes equipment displayed at the Chicago Chemical Show in October.

ROY E. ROTH CO. DEPT. P-51

2420 4TH AVE. ROCK ISLAND, ILL.

TEMPORARY STRAINERS

MAC-IRON

Established 1901

Made by a skilled mechanic and not by "just some guy with a torch."

REVOLUTIONARY CONSTRUCTION

Smooth, efficient contours . . . no weld "blob" around edge of ring. The flange is precision rabbeted into the ring joint gasket making deformation at that point impossible.

MAC-IRON offers a complete listing of line and temporary strainers. The latter of woven wire, perforated basket and conical . . . all for use with raised face, and ring joint flanges.

A large stock on hand is maintained; special strainers made to specification. Write direct for a catalog and complete information.

The Mack Iron Works Company

Warren and Water Sts. Sandusky, O.

Suppliers . . .

and Tolhurst Centrifugals division, replacing Hardy Bach, who resigned.

Three Receive Appointments At Nordberg Manufacturing

Lieberherr

Grieshaber

Miller

Hans U. Lieberherr has been appointed director of engineering, Emil Grieshaber director of projects development, and Ralph Miller consultant and director of supairthermal development and application in the Heavy Machinery division of Nordberg Manufacturing Company.

Lieberherr joined Nordberg as its technical representative throughout Europe, with headquarters at Paris, in 1949. Grieshaber has been with the company since 1915. He provided technical assistance in the development of the early diesel engines built by Nordberg. Prior to his new appointment, Grieshaber was chief engineer. Miller joined the Nordberg organization in 1945 as chief engineer of the Four-cycle Engine department.

In their new posts, Grieshaber and Miller will be concerned with research and development, Lieberherr with engineering development.

Minneapolis-Honeywell Buys Assets of Heiland Research

Assets of Heiland Research Corporation of Denver, Colo., manufacturer of scientific instruments and photographic flash equipment, have been purchased by Minneapolis-Honeywell Regulator Company.

The 20-year-old Denver firm will be operated as a new Honeywell division. The Heiland part of the name will be retained in the new name. The new division will continue to operate from its Denver plant and offices.

To Represent De Laval

Gumersindo Garcia, S.A., has been appointed exclusive representative for De Laval Steam Turbine Company, of Trenton, N. J., in Spain, Spanish Morocco, Tangiers, the Balearic and Canary Islands.

Huesmann of National Can Dies

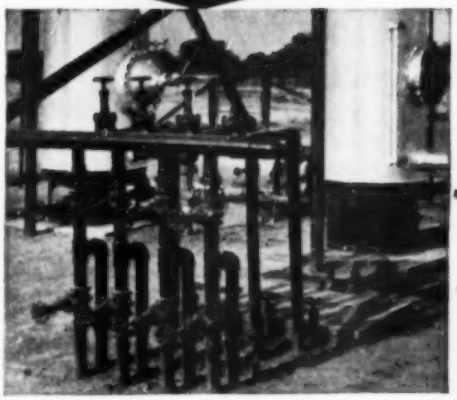
E. B. Huesmann, manager of the Tinplate department of National Can Corporation, died in Chicago August 15. He

WALWORTH VALVES on the job in the petroleum industry

They're easily disassembled for cleaning. That's why a prominent petroleum company* uses Walworth Iron Body Saddle Gate Valves on this production header in their Oklahoma plant.

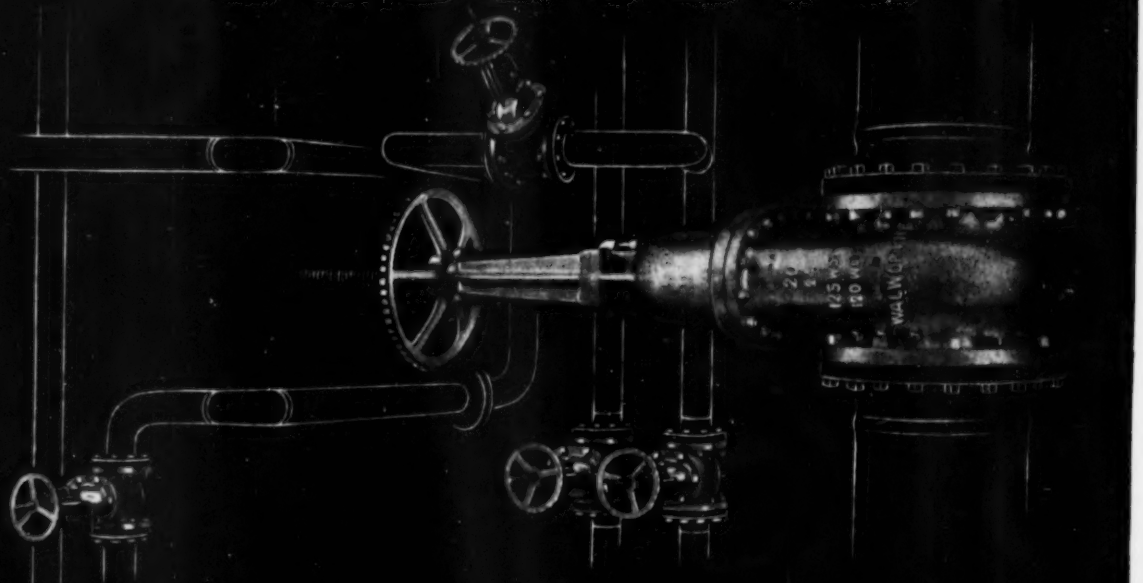
Walworth manufactures complete lines of Gate, Globe, Angle, Check, and Lubricated Plug Valves in steel, iron, bronze, and special alloys for all types of refinery service. Detailed information may be obtained from your nearby Walworth distributor, or by writing: Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.

*Name on request

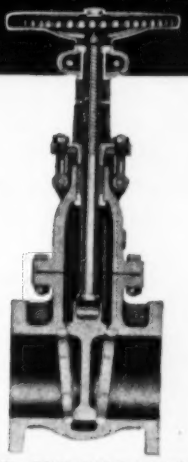


For more data on advertised products, use Readers' Service Cards, last page.

WALWORTH



IRON BODY WEDGE GATE VALVES



Walworth No. 726F OS&Y (Outside Screw and Yoke) Iron Body Wedge Gate Valve. OS&Y valves are recommended for services where it is desirable that the line fluid does not come in contact with the stem threads. Note the swing-type gland-eye-bolts for easy repacking. Sizes 2 to 30 inches.

Better because ...**The entire valve, from handwheel to seat rings, is ruggedly constructed to withstand rough and frequent usage. Body, bonnet, and yoke are sturdy castings with large radius fillets. Dimensions and drilling of end flanges are in agreement with American Cast Iron Flange Standards. Stiffening ribs connect end flanges with the body neck to maintain a rigid connection with piping.**

A wide range of Walworth Iron Body Wedge Gate Valves is available—through your Walworth Distributor—from which you can choose the right type to meet your most exacting conditions. Saddle-type valves as small as ¼-inch; low pressure valves for water and gas pipelines up to 36 inches.

Whenever you need valves and fittings, choose from complete lines—in a variety of metals—manufactured by Walworth. For more information, see your Walworth Distributor or write: Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

For more data on advertised products, use Readers' Service Cards, last page.

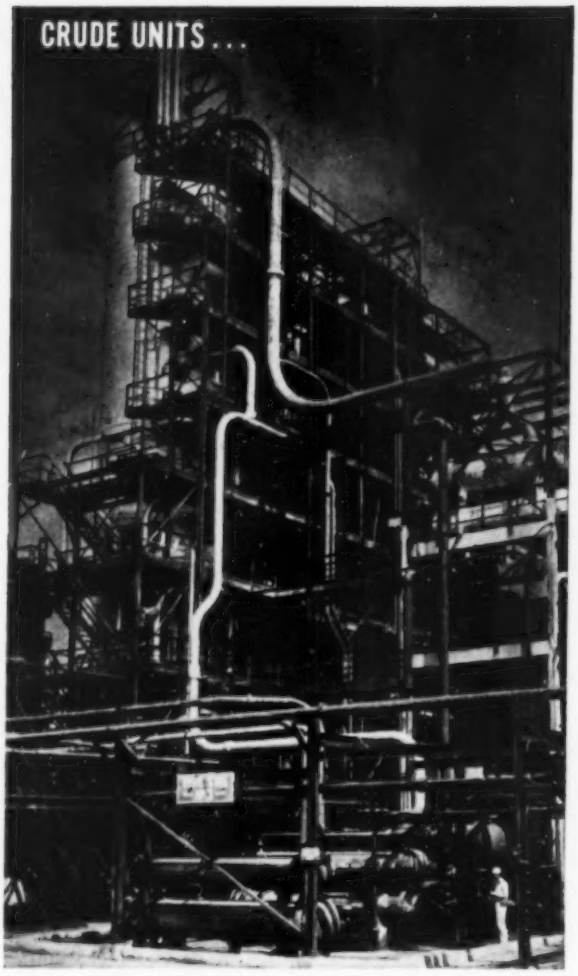
POLYRAD CONTROLS ACID CORROSION

all around the refinery

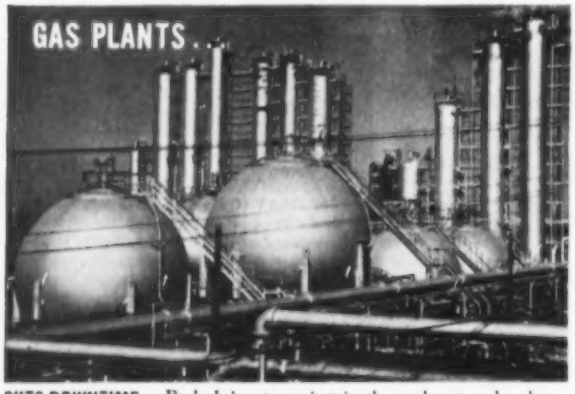
From crude units to gas plant areas, Hercules Polyrad controls corrosion, helps maintain throughput, increases heat transfer, reduces metal loss, and cuts down time for maintenance.

A filming amine inhibitor, Polyrad forms a protective molecular film that safeguards refinery equipment from hydrogen-ion attack by organic and inorganic acids. Developed through Hercules research, Polyrad was specifically designed to control corrosion at low pH and it is highly effective over the entire pH range encountered in refinery operations.

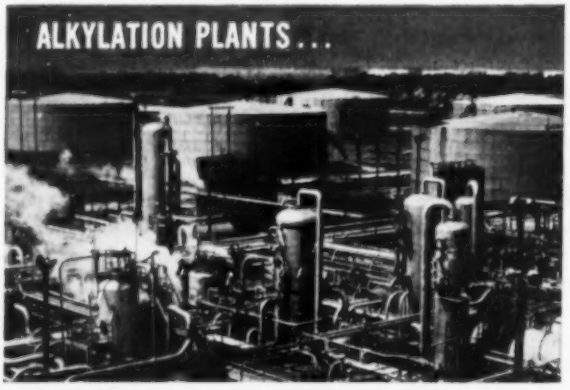
Polyrad is quickly available from stocks located strategically throughout the nation. One of our technical representatives will be glad to work with you in evaluating Polyrad under your operating conditions. For additional data, write Hercules.



A PLUS FEATURE of Polyrad through the refinery is its detergent action which loosens iron sulfide and other scales so that they can be removed in the fluid stream.



CUTS DOWNTIME — By helping to maintain throughput and reducing metal loss, Polyrad keeps down time for maintenance to a minimum any place in the refinery where acidic corrosion or fouling is a problem.



POLYRAD PROTECTS many types of refinery equipment from hydrogen-ion attack. It is useful in condensers, distillation columns, re-boilers, and heat exchangers.

Naval Stores Department

HERCULES POWDER COMPANY

INCORPORATED

976 Market St., Wilmington 99, Del.

POLYRAD®

FILMING AMINE INHIBITOR

NA54-6

Suppliers . . .

had been in the can industry for more than 30 years, serving as manager of Tinplate for Can, Inc., prior to the merger of that company with National Can about a year ago.

Warren Transfers Creel To New Position at San Pedro

Stigletts Creel

A new district sales office has been opened by Warren Petroleum Corporation at its new Deepwater terminal for storage and distribution of natural gasoline at San Pedro, Calif.

Manager of the new office is Fred Creel, who was transferred from the managership of the district sales office at Houston. He has been succeeded at Houston by H. J. Stigletts, formerly of the sales staff at the corporation's Tulsa office.

Garlock Packing Names Sewell New General Sales Manager

J. B. Sewell, of Toronto, has been appointed general sales manager of The Garlock Packing Company of Palmyra, N. Y.

Sewell

In his new capacity Sewell will direct from Palmyra the sales of Garlock products through the company's 29 divisional offices throughout the U. S. and Canada.

Starting with Garlock in 1935 as salesman for the Montreal area, Sewell was appointed vice president of The Garlock Packing Company of Canada, Ltd., in 1947. As such, he has been in full charge of the sales activities of the Canadian company.

New Firm Formed in Tulsa

Tuloma Builders, Inc., is a new firm formed in Tulsa to handle engineering and construction of oil and gas facilities. The new organization will handle gasoline plants, industrial plants, gas-compressor stations, oil pump stations and water flood units.

Top personnel of Tuloma were formerly with Midwestern Construction Constructors, Inc. Clyde Wyant, formerly vice president of Midwestern, is now Tuloma president. T. F. Hansen, chairman of the board, was formerly Midwestern's general office manager, and

Lightweight Vise that's also a Work Bench... it's

RIDGID

Tristand

...with built-in folding tray

Stand and tray are all one unit—no loose parts. Quick easy set-up and take down. Extra-light weight but strong, rigid. Full size vise base—3 benders, ceiling brace screw, pipe rest, lots of tool slots. An unbeatable value—see it at your Supply House!

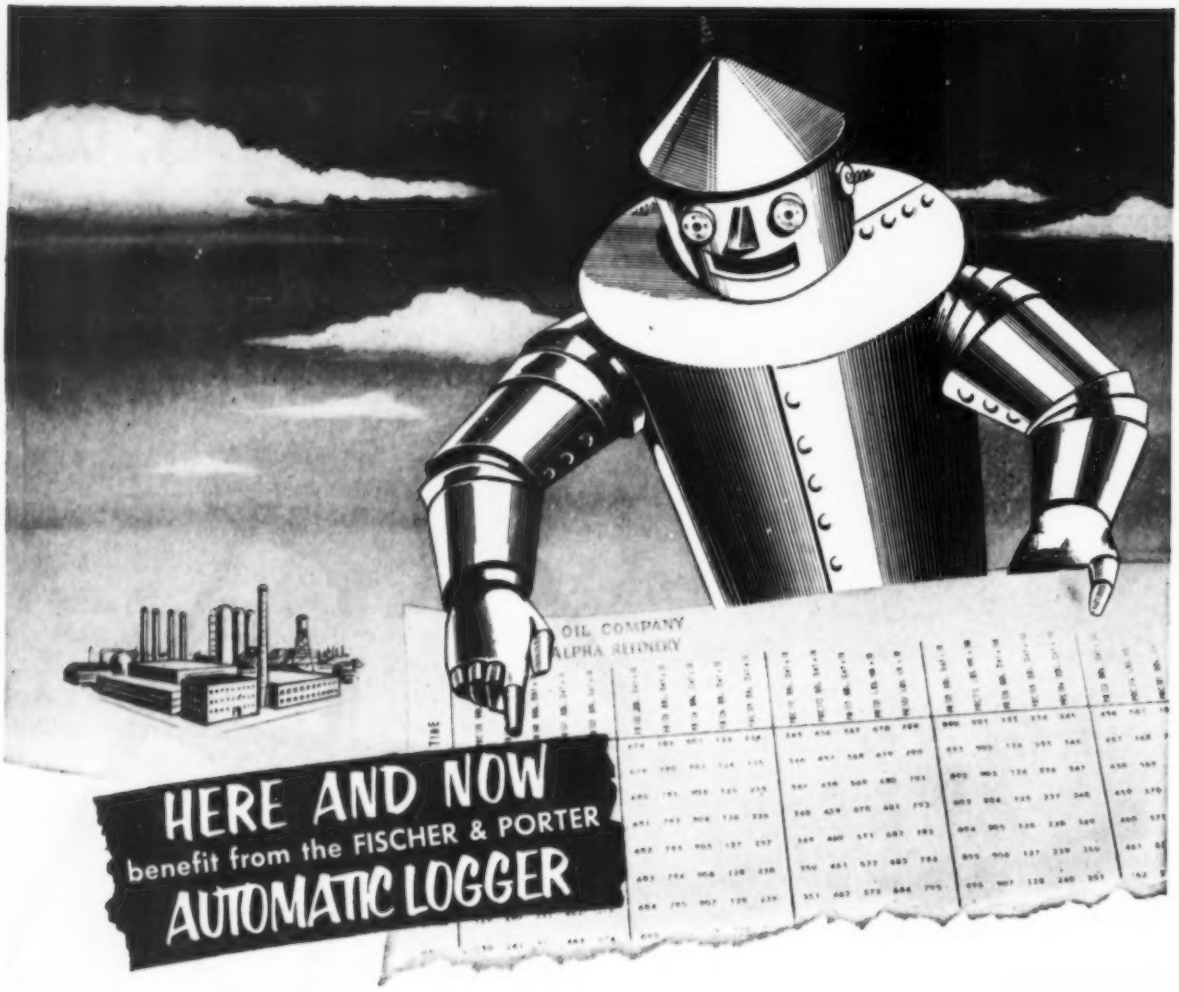
Tray pushes up easily to fold Tristand, pushes down easily to set up. Holds stand rigid.

Folds up for easy carrying to job and it's extra lightweight.

The Ridge Tool Company • Elyria, Ohio, U. S. A.

RIDGID

Work-Saver Pipe Tools



CHECK THESE ADVANTAGES

- translates pneumatic and electrical signals into digital form for automatic controlling, computing and accounting.
- reduces instrumentation investment—saves space.
- increases efficiency with quick, accurate reporting.
- continuous scanning monitors operating conditions, announces and records off-norm actions at any time.
- relieves personnel now needed for manual logging, relating and interpreting operating information.

You now have immediately available a packaged data reduction system with great versatility for present application or later re-application . . . ready to integrate into your plant the latest means for computing, controlling and accounting.

The F&P Automatic Logger converts pneumatic and electrical signals into tabulated digital records specially designed for your needs. Logging occurs at preset intervals—but Logger *continuously* samples essential variables and stores information for interval recording. Thus, flow may be integrated continuously and logged as accumulated flow or average flow rate. The F&P Logger employs analog computer techniques to reduce data to suitable form before digital presentation.

The F&P Automatic Logger tabulates useful data on automatically typed log sheet and simultaneously stores it on punched tape or in other digital form for automatic *controlling, computing* or *cost accounting* without the expenditure of a *single man hour.*

The F&P Automatic Logger is available *now*—ready to implement your new automation plans, ready to lower operating costs. Write for complete information or actual demonstration.

complete process instrumentation

FISCHER & PORTER CO.

1004 County Line Road, Hatboro, Pa.

MEASURING, RECORDING AND CONTROLLING INSTRUMENTS • CONTROL PANELS • DATA REDUCTION SYSTEMS
CONTRACT INSTRUMENTATION RESEARCH • CHLORINATION EQUIPMENT • GLASS SPECIALTIES

Suppliers . . .

J. A. Bard, vice president, was formerly a Midwestern vice president.

American Chain & Cable Names Dallas-Tulsa Representative

Joe H. Williams has been appointed sales representative for the Helicoid Gage Division of American Chain & Cable Company in the Dallas-Tulsa area.

Williams

From headquarters at Dallas, Williams will cover the northern parts of Texas and Louisiana, and all of Oklahoma.

Prior to joining the American Chain & Cable organization in February of this year, Williams was with Stone & Webster Engineering Corporation, The Lummus Company and Bowen Company of Texas, Inc.

American Potash Builds Lab

A new $150,000 control laboratory has been completed and put into operation at American Potash & Chemical Corporation's main plant at Trona, Calif. Stearns-Rodgers Manufacturing Company, Denver, Colo., built the two-story structure, which measures 60 feet long and 40 feet wide. Function of the control laboratory is constant testing of chemical solutions before, during and after their processing at the production plant.

Thurston Gets Publicity Post

Wesley S. Thurston has joined the advertising and promotion staff of Copper & Brass Research Association in New York. Thurston has been active in publicity and radio newswork, and was formerly assistant publicity director at The Glenn L. Martin Company.

Tube Turns Adds Distributor

The Pacific Metal Company, Portland, Ore., has been appointed a distributor of aluminum welding fittings and flanges for Tube Turns, a division of National Cylinder Gas Company.

GUNITE
Since 1915
CONCRETE
SAND AND CEMENT
"Placed by Air"

We have completed over 2600 exclusive GUNITE contracts including — LININGS ENCASING — INSULATING — REPAIRING NEW CONSTRUCTION.

Send for specifications and bulletins
No obligation
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GUNITE CONCRETE & CONST. CO.
1301 WOODSWETHER RD., KANSAS CITY 5, MO.
2016 W. WALNUT, CHICAGO 12, ILL.
2036 ADDISON, HOUSTON 25, TEXAS
St. Louis—Minneapolis—Denver—New Orleans

General Controls Transfers Andrews to California Post

Stan Andrews, regional manager for the Dallas, Texas, area of General Controls Company, has been moved to the company's California headquarters to be manager of the Appliance Controls division.

Andrews

Andrews, who has been with the company for eight years, will be located at the firm's recently dedicated new appliance controls plant in Burbank, adjacent to the main General Controls plant in Glendale.

In his new assignment, he will supervise all phases of marketing the company's line of automatic controls.

Honeywell Training School Graduates Turkish Students

Minneapolis-Honeywell's Industrial Division Training School in Philadelphia recently graduated eight Turkish oil refinery employes. The students completed a special two-week course in the basic principles of automation. The students will shortly return to Batman, Turkey, where they are employed by the Batman refinery.

Perkin-Elmer Forms Division

Formation of a new manufacturing division has been announced by The Perkin-Elmer Corporation. Known as the Vernistat division, the new unit will be devoted to the development, manufacture and sale of Vernistats, a new type of precision variable-ratio transformer. Eugene W. Dunstan, formerly director of purchasing at Perkin-Elmer, has been named general manager of the new division.

Kaiser Steel Appoints Bowles

Robert W. Bowles has been named manager, specialty steel sales, for Kaiser Steel Corporation. He will direct the company's sales of pipe for fence posts, gusset plates and other specialty steel products. His offices will be at Oakland, Calif.

Prior to his recent appointment, Bowles was assistant to the manager of engineering sales.

Sharples Assigns Binns

Melbourne P. Binns has been named senior salesman for the St. Louis territory of Sharples Chemicals Inc. In this capacity Binns will handle the company's extensive line of synthetic organic chemicals and specialties including alcohols, esters, alkyl phenols, amines, rubber chemicals and fuel gas odorants.

Binns joined the Sharples organization in 1952 as a member of the market development staff.

OIC Licenses Canadian Firm

Sheepbridge Engineering (Canada) Ltd., Guelph, Ont., has been licensed to manufacture cast steel industrial valves

YOU CAN LOWER YOUR OPERATING COSTS — IF YOU USE A COMPETENT WATER CONTROL SERVICE REGULARLY

AQUATROL

ALWAYS CALL . . .

AQUATROL, INC.

WE GUARANTEE TO SAVE YOU MONEY — THROUGH EFFECTIVE CONTROL OF YOUR INDUSTRIAL WATERS

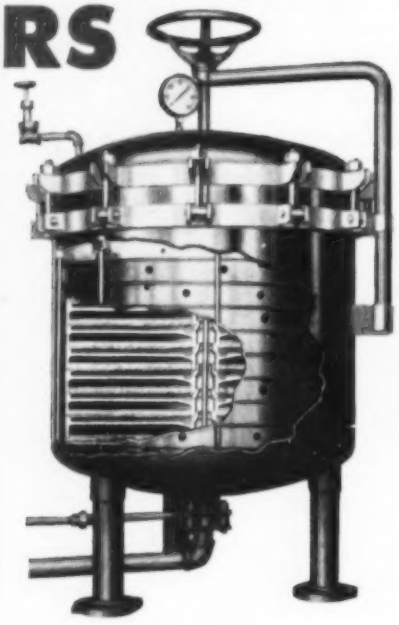
Write Today for Proof!
P. O. Box 12345
HOUSTON 17, TEXAS
Phone: HUdson 6-7784

AQUATROL

For more data on advertised products, use Readers' Service Cards, last page.

SPARKLER
HORIZONTAL PLATE
FILTERS

Noted for High Quality, Consistently Uniform, Fine Sharp Filtration of Petroleum Products....



Many times Sparkler filters have been chosen by experienced filtration engineers in the petroleum field because of these specific features of superiority.

Sparkler filters deliver unusually high flow rates due to the horizontal plate construction that requires only a very thin precoat to produce fine sharp filtration right from the start. Less pressure is required with a thin precoat resulting in a filter cake of less density and high flow capacity. Intermittent operation or variation in pressures will not disturb the stability of the filter cake.

Any grade of filter paper, cloth, or screens, and any filter aid can be used with maximum efficiency because no pressure is required to hold the filter cake on the plate.

Frequently Sparkler filters are used in the petroleum industry with various grades of paper only without filter aid to perform a specific job that would be difficult or impossible with some other types of filters such as the removal of water from diesel lube oil or transformer oil.

A few typical applications of Sparkler Filters to the Petroleum and petro-chemical industries for the filtration of:

- Canned lubricating oil
- Methyl-Ethyl-ketone
- Polyisobutane
- Chlorinated hydro-carbons (carbon tet.)
- Aviation gasoline
- Jet engine fuel
- Hydraulic oil
- Gas engine & diesel lubricating oil (both continuous recirculation on the engine and batch-wise)
- Diesel fuel oil
- Cooling tower water
- Plant effluent water (to obviate stream and lake pollution)
- Removal of Raney nickel from alcohol streams
- Insecticides
- Caustics & acids
- Cottrell precipitator insulating oil (carbon black plants)

Sparkler horizontal plate filters are available in capacities from 30 to 30,000 G.P.H. depending on type of product filtered. Can be supplied in carbon steel, stainless steel, pure nickel, or monel, bronze, Hastelloy and Inconel. Rubber lined, brine or steam jacketed.

Sparkler representatives for personal engineering service are located in Dallas, Houston, San Francisco, and other principal cities. Western Branch, Los Angeles, California.

SPARKLER

Write Mr. Eric Anderson for your nearest Sparkler service representative.

MANUFACTURING COMPANY
MUNDELEIN, ILL.

Sparkler International, Ltd. Prinsengracht 876 Amsterdam, Holland

MAKERS OF INDUSTRIAL FILTERS FOR OVER A QUARTER OF A CENTURY

Suppliers . . .

for The Ohio Injector Company, Wadsworth, Ohio. Sheepbridge Engineering is a subsidiary of Sheepbridge Engineering, Ltd., Chesterfield, England.

New Steel Fabrication Firm Now Operating Plant in Tulsa

McKelvey, Sr.

Haughton

A new company, McKelvey Steel Corporation, has been formed in Tulsa to specialize in structural, pipe and pressure vessel fabrication, and also hard-surfacing and reclamation of used flux. Officers of the new firm include L. N. McKelvey, president, Lenard Haughton, general manager, and L. N. (Bud) McKelvey, Jr., chief engineer.

The company has purchased an established plant in Tulsa and has doubled its capacity. Plans are under way to re-double the plant's present capacity.

The president of the company was formerly with Pioneer Tank and Boiler Company and Vulcan Steel Tank Corporation. Haughton was with Vulcan prior to joining McKelvey. The younger McKelvey was formerly a product design engineer at Graver Tank and Manufacturing Company. Alfred B. Kern has been appointed sales representative for McKelvey.

Key Appoints Manager for Cleveland District Office

Appointment of Robert D. Burkhart as manager of its Cleveland district office has been announced by Key Company.

Burkhart

Burkhart has been with Key Company since 1934. His background of experience includes plant operations, engineering, refinery equipment sales and reconditioning service.

As manager of the company's Cleveland district office, Burkhart succeeds William P. Clary, recently resigned.

Yarnall-Waring Moves Office

The Midwestern sales office of Yarnall-Waring Company has moved to new and larger quarters at Room 308, Machinery Hall Building, in Chicago. At the same time, F. M. Carson, H. R. Peterson and G. J. Wagner were added to the Chicago sales staff.

HELP WANTED

MECHANICAL DESIGN ENGINEERS

Employment Opportunities in

SOUTH AMERICA

Attractive staff positions available with affiliates of STANDARD OIL COMPANY (N. J.). Engineering degree and 3-5 years oil refinery or chemical plant design experience required.

Liberal salaries and benefits.

WRITE giving age, education, marital status and detailed experience resume.

Box 308-A
Radio City Station
New York 19, N. Y.

FOR SALE

■ PROJECT ENGINEERS: Requires a mechanical or chemical engineering degree and at least 5 years diversified experience in petroleum and chemical plant design and development work. Will be responsible for coordination of process and design to insure customer specifications are met. There is considerable customer and vendor contact. These are permanent positions with an internationally-known organization located on the East Coast. Salaries are high, and the many employee benefits include executive insurance and a liberal pension plan. Traveling and moving expenses will be paid. Please write complete details and include initial salary requirements. Box #421, Room 1201, 230 West 41 St., New York 36, N. Y.

GLASSES & GASKETS

ALL SIZES TO FIT YOUR GAGES & VALVES
ERNST WATER COLUMN & GAGE CO.
Send for Catalog, LIVINGSTON, N. J.

PETROLEUM REFINER Classified Ads

FOR SALE

EQUIPMENT SPECIALS!

TOWERS & COLUMNS

8′ x 61-6 stainless steel, 15 trays
7′ x 25-6 stainless steel, 10 trays
6′ x 64′ stainless steel, 35 trays
6′ x 45′ stainless steel, 850 psi
4′ x 110′ stainless steel, 70 trays
4′ x 72′ stainless steel, 45 trays
2′ x 73′ stainless steel, 50 trays
2′ x 39′ stainless steel, 30 trays
7′-6″ x 55′ steel tower, 30 trays
7′ x 42′ steel tower, 20 trays
7′ x 5′ x 70′ steel tower, 35 trays
6′ x 63′ steel tower, 35 trays
5′ x 61′ steel tower, 15 trays
4′ x 72′ steel tower, 40 trays
3′-6″ x 63′ steel tower, 35 trays
2′-6″ x 60′ steel tower, 35 trays
2′ x 75′ steel tower, 45 trays

HEAT EXCHANGERS

2—1440 sq. ft. stainless steel
75—atmospheric heat exchangers, steel and stainless in 715, 477, 358, 108 sq. ft. sizes.
5—Karbate 188,170 sq. ft., unused.
2—1125 sq. ft. steel, 850#
9—Kettle type reboilers, steel and stainless 1270, 1125, 750, 660, 400, 340, 100, 80, 50, 31 sq. ft. sizes.
1—245 sq. ft. Admir, 125#, unused.

OTHER ITEMS

1—Gould cen. pump, 10,000 GPM, 135′ head; Sharples S8 Super-D-Canter centrifuge
2—1,000 gal., 1200# vessels, unused.
2—1380 gal. stainless steel tanks, 90 psi; 3—6′ x 32′ heresite lined tanks 74 psi.
60—turbine-driven centrifugal pumps, steel and stainless construction from 1″ x 1″ to 8″.
2—Pacific six-stage centrifugal pumps, 730 GPM
4—B-J stainless steel pumps, 8″ x 6″, 1500 GPM
2—Oliver 8′ x 10′ rot. vac. filters, complete; 1—Bird 36″ x 50″ solid bowl centrifuge.
2—Drum flakers 5′ x 12′, 4′ x 6′; 1—Devine 2000 gal. steel jacketed reactor.
Sweetland filters No. 12, 10, 7, 3 sizes; Niagara type, H hortizontal filter, 450 sq. ft. unused.
2—Unused I-R air compressors with 3580 cfm with GE 600 hp sync. motors, in original crates.
Clark, type VT, TR spare cylinders; Nash H-6 (H-7, H-8) vac. pumps.
3—I-R steam-driven propane compressors, 5400 #/hr.
2—Clark MA-4 Right angle gas engine compressors, 150 BHP
High pressure gas-fired tube still furnace, 15 Mil BTU hr.
2—Union Iron Works 30,000 #/hr. water tube boilers, 240 psi, complete.
Complete Oxygen plant, built by Stacey-Dresser, 170 Tons day. Complete details on request.
Full complement of instruments; flo, temp, pressure recorders

BRILL EQUIPMENT COMPANY
4101 SAN JACINTO STREET, HOUSTON 4, TEXAS
Telephone: JUstin 6032
A SINGLE ITEM OR A COMPLETE PLANT

Write, wire or phone us for complete information — Send us your surplus equipment lists today

Suppliers . . .

Beaver Pipe Tools Appoints Herig Field Sales Manager

Russell Herig, formerly associated with Nye Tool Company, Chicago, has been appointed field sales manager for Beaver Pipe Tools, Inc., Warren, Ohio.

Herig

Herig joins Beaver Pipe Tools with over 21 years of technical experience in the mill supply business. Prior to his association with Nye Tool Company, he was sales representative for Long Island Hardware Company and C. H. Tieboutt and Sons Company, New York.

In his new capacity at Beaver Pipe Tools, Herig will make his headquarters at Warren.

Three Draw Promotions in Lukens Steel Sales Division

Lukens Steel Company has announced three promotions in its Sales division:

W. Harrison Lackey, former manager, plate sales, is the new manager, field sales.

Charles A. Carlson, Jr., advances to manager, carbon plate sales. He was assistant manager, New York district sales office, working from the Albany, N. Y. office.

Robert L. Cahoon, former assistant manager, clad and foreign conversion, becomes manager, alloy plate sales.

Both Lackey and Carlson started with Lukens in 1939. The former headed the Pittsburgh sales office for a time, and Carlson formerly was in the company's Washington sales office.

Cahoon joined Lukens Research department in 1946 and transferred into the Sales division two years later.

Worthington Appoints Ziegler

George L. Ziegler, assistant works manager of Worthington Corporation's Buffalo Works since 1951, has been appointed manager, parts service for the corporation. Ziegler will make his headquarters at Harrison, N. J.

A. O. Smith Gives Henry Pacific Coast Assignment

F. A. Henry, formerly assistant to the general manager of A. O. Smith Corporation, Milwaukee, Wis., has been advanced to general manager of the corporation's Pacific Coast Works at Los Angeles. He succeeds A. W. Shuman, resigned.

Henry

Henry joined A. O. Smith in 1953 as an assistant to the vice president and general manager. Prior to that he had been Air Force plant representative at the Wichita division of Boeing Airplant Company and chairman of the B-47 Production Committee.

Girdler Moves at Toronto

The headquarters of the Girdler Corporation of Canada Limited have been moved from 143 Yonge Street to Suite 911, 111 Richmond Street, West, Toronto.

For more data on advertised products, use Readers' Service Cards, last page.

REPUBLIC ALLOY STEEL STUDS

KEEP PRESSURES LOCKED IN TIGHT

● On shut-off valves, headers, pressure vessels, on all high-pressure refinery equipment Republic Alloy Steel Studs provide maximum holding power. Keep pressures locked in tight.

Clean, accurate threads for full engaged-thread area plus dependable Republic Alloy Steels assure you of maximum service . . . even under the most severe pressure, heat and corrosive conditions. Specify Republic Alloy Steel Studs for new pressure vessels. Carry them in stock for replacements.

REPUBLIC STEEL CORPORATION
Bolt and Nut Division • Cleveland 13, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

REPUBLIC BOLTS AND NUTS

Other Republic Products include: Bolts, Studs, Nuts and Rivets—Pipe—Sheets—Plates—Electrunite Heat Exchanger Tubes

What's New In Equipment . . .

Computer Solves Engineering Problems

The refining, natural gasoline and petrochemical industries got their first glimpse of National Cash Register's new electronic computer at a special demonstration showing at Houston. Called the Model CRC 102-A electronic Computer with auxiliary Magnetic Tape Unit Model CRC 126, this electronic brain is designed to (1) process all types of data, (2) solve endless engineering and accounting problems, and (3) keep records for scientific, engineering and business operations. This new system consists of three major units: (1) the Computer, a Magnetic Tape Unit and a control console. In addition, auxiliary equipment includes a Flexowriter with attached paper tape reader and paper tape perforator, an IBM Type 523 Summary Punch used for reading cards, and as many as eight CRC 126 Magnetic Tape-Handling units.

The Computer is designed to accept properly organized numerical information as it is typed on the Flexowriter keyboard, which may be operated manually or by means of the attached paper tape reader. Tapes may be prepared in advance or when the information is entered manually. Paper tapes provide a useful storage medium for standard lists of instructions which are used as subsections of more complicated routines or for the processing of day-to-day business. The Flexowriter is also used as an output printer for the Computer. Results may be typed on cards, pages, prepared forms, or masters for the duplicating processes.

The Magnetic Tape-Handling Unit records information and has a capacity equal to that of 64 magnetic drums. Information so stored can be relocated when needed. To operate electronic and punched-card systems, the CRC Model 102-A Computer is fitted to read and punch IBM cards.

Thirty-six or fewer columns of data or four complete instructions may be read into the computer from each card. A magnetic storage drum in the computer is capable of retaining at one time the information read from 256 such cards.

Available on a lease-purchase plan or outright purchase, this new computing system offers a wide variety of applications in the refining, natural gasoline and petrochemical industries. Accounting problems, business analysis, marketing problems, solution to complicated engineering and design problems are but a few of the possibilities of this machine.

Circle E1 on Postcard

Protective Coating

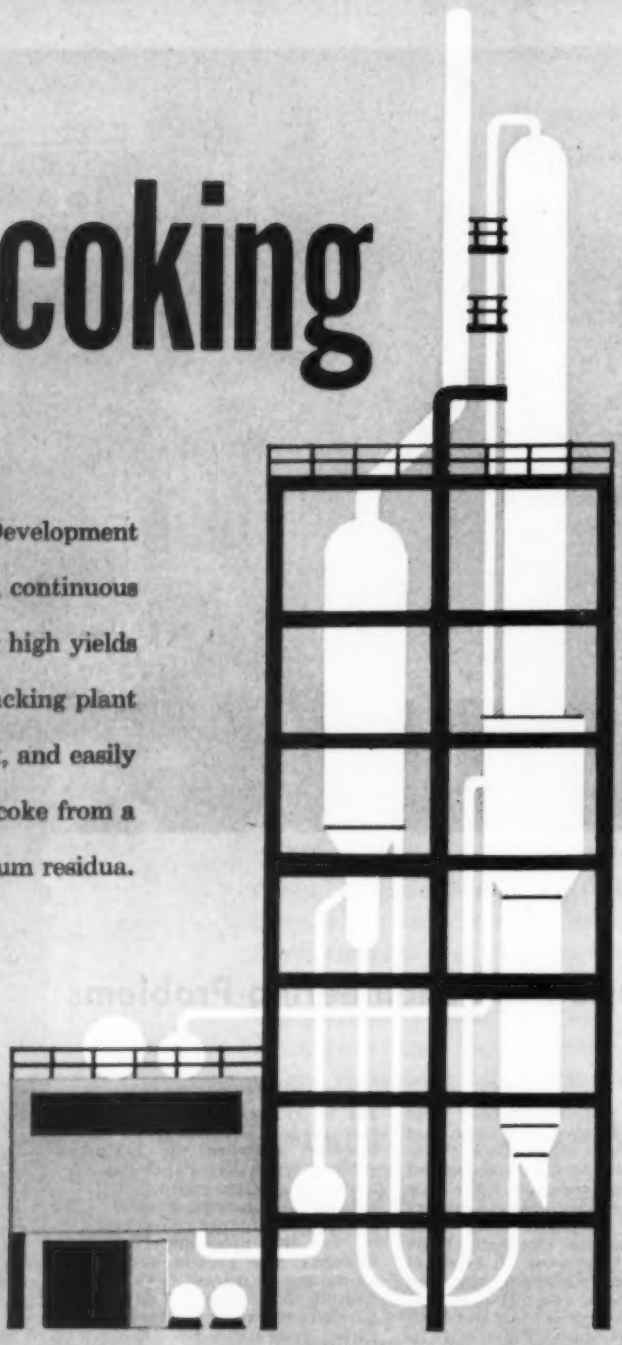
The Lambert Corporation has developed and is now introducing a new protective coating that resists the corrosive effects of acids, caustic, brine, detergents and most other deteriorating substances normally encountered in the refining natural gasoline and petrochemical industries.

The new product, Lambco Chemical Proof Enamel, has been thoroughly tested and proved resistant to the effects of nitric, hydrochloric, and acetic acids as well as sodium hydroxide, chlorine gas, calcium chloride, many refinery crudes, gasoline, and various detergents. All laboratory tests were made at temperatures of from 75 to 160 F.

This new enamel utilizes the resin, Epon, and can be either sprayed or

fluid coking

Standard Oil Development Company's flexible, continuous process for producing high yields of catalytic cracking plant charge stock, and easily handled, fluidized coke from a variety of petroleum residua.



Blaw-Knox is licensed to offer the fluid coking process under patents of the Standard Oil Development Company

BLAW-KNOX

BLAW-KNOX COMPANY chemical plants division

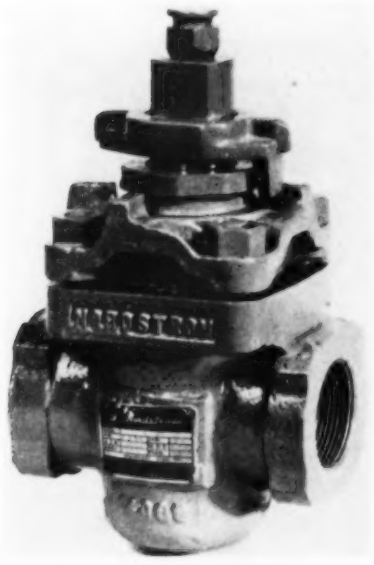
Tulsa 1, Oklahoma / Pittsburgh 22, Pennsylvania / Chicago 1, Illinois

New Equipment . . .

brushed. It dries dust free in 30 minutes and can be re-coated in from 4 to 6 hours.

Complete details on this new chemical proof enamel are available now. Just . . .

Circle E2 on Postcard



Stainless Steel Valves

A new line of lower priced stainless steel Rockwell - Nordstrom lubricated plug valves recommended for use in the refining natural gasoline and petrochemical industries has been introduced by the Meter and Valve division of Rockwell Manufacturing Company.

The new valves feature chrome-plated plugs and are suitable for many services in which the more expensive stellite-coated steel valves have previously been used. The chrome plating backed by stainless steel offers double protection against scoring, galling and other effects of corrosion.

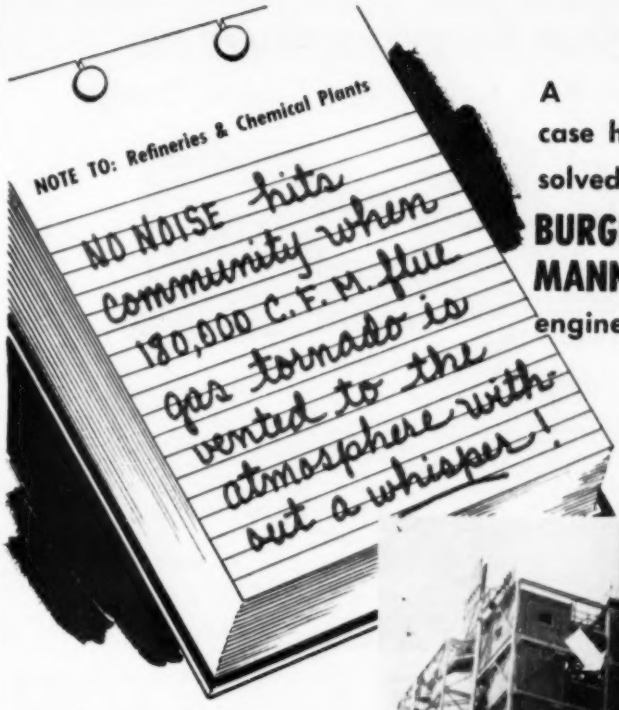
This item supplements Rockwell Manufacturing Company, Nordstrom Valve division data on pages 645-652 of The Refinery Catalog, 21st edition.

Circle E3 on Postcard

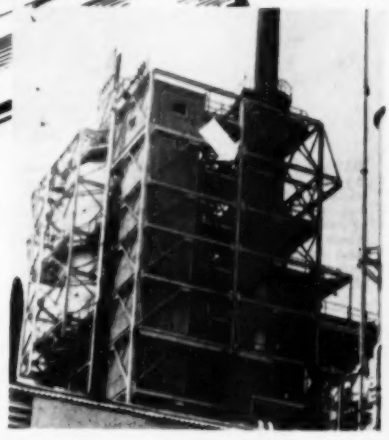
Particle Sizing

Fisher Scientific Company is announcing the availability of a calibrator attachment for the Sub-Sieve Sizer. This sizer is a patented instrument that measures small (0.2 to 50 microns) particles by determining the resistance to air-flow of a weighted column under standard packing conditions.

The calibrator attachment is a natural ruby with a tiny orifice in the center. It is mounted in a precision-bore tube of the same dimensions as the sample tube, and is connected to the air duct in the same manner as the sample tube. The instrument is adjusted by bleeding off the requisite amount of air to make the manometer height agree with the


NOTE TO: Refineries & Chemical Plants
NO NOISE hits community when 180,000 C.F.M. flue gas tornado is vented to the atmosphere with out a whisper!

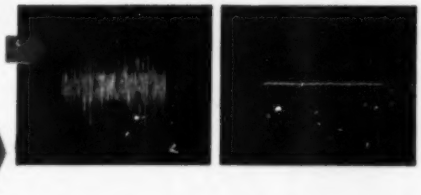
A case history solved by **BURGESS-MANNING** engineers!



The intense discharge roar of a catalyst regenerator on a fluid catalytic unit was more than the surrounding area could take without protest. For the sake of good public relations, something had to be done — so Burgess-Manning engineers were called in. The installation of a Burgess-Manning 66" Flue Gas Snubber effectively hushed the Big Noise.

Refinery plant becomes a Better Neighbor when Burgess-Manning Snubbers quiet roar.

When a Burgess-Manning Snubber is installed, the high velocity gas that produces annoying roar is converted to a smooth and quiet stream



BURGESS-MANNING COMPANY

1203 DRAGON STREET
DALLAS, TEXAS

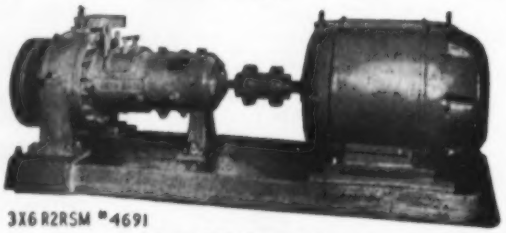
Sound Engineering

LIBERTYVILLE, ILL.
CHICAGO, ILL.

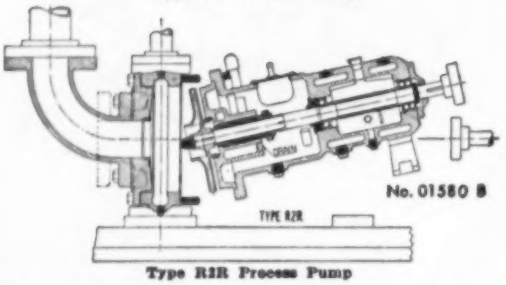
For more data on advertised products, use Readers' Service Cards, last page.

DEAN BROTHERS PUMPS INC.

Type R2R Centrifugal Process Pumps



Type R2R Process Pump



Type R2R Process Pump

DISASSEMBLY: The Type R2R process pumps can be disassembled without disconnecting the suction and discharge piping. By first removing the spacer from the spacer type coupling, and unbolting the casing from the cradle the entire cradle and complete rotating element can be removed without disturbing the suction and discharge piping.

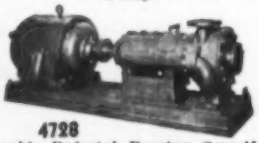
OPERATING RANGE: Type R2R. Heavy duty, process pumps are available in eighteen different sizes, enabling our engineers to furnish units specially designed and constructed for the particular work to be performed.
Capacities: 50 to 2000 Gallons per minute. Heads: Up to 400'. Speeds: 900 RPM to 4000 RPM.

BUILDERS OF OUTSTANDING PUMPS SINCE 1869

CENTRIFUGAL and RECIPROCATING PUMPS

4040H
Close Coupled Centrifugal Pump

4043 AA
Pedestal Mounted Centrifugal Pump



4728
Double Pedestal Bearing Centrifugal Pump

3510
Horizontal, Single Style, Double Acting, Piston Type, Close Clearance Pump. Designed to handle volatile liquids

3833
Horizontal, Duplex, Double Acting, Side Pot, Piston Type, Oil Bath Power Pump

3556
Durable Duplex Packed Piston Pattern Steam Pump, Side Pot Type

ESTABLISHED 1869

DEAN BROTHERS PUMPS INC.

INDIANAPOLIS IND.

323 W TENTH ST.

Branch Offices: NEW YORK, N. Y., HOUSTON, TEXAS

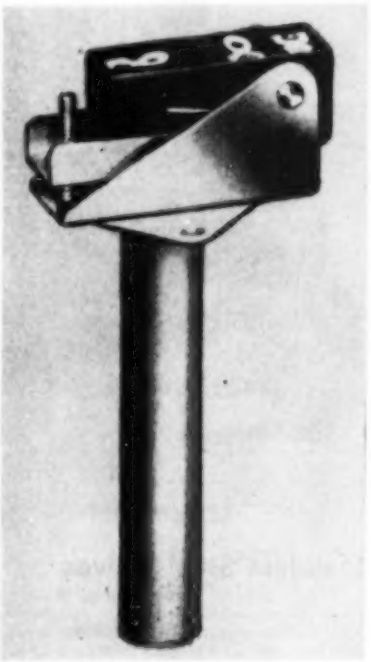
Representatives in Principal Cities

New Equipment . . .

value engraved on the side of the calibrator.

This new instrument should find many applications in catalyst studies in the refining, natural gasoline and petrochemical fields. For complete technical details on this new product, simply . . .

Circle E4 on Postcard



Snap-Action Thermostat

Fenwal Incorporated has developed a series of liquid-filled, snap-action type thermostats designed to meet the need for thermostats having both a heavy duty load carrying capacity and a small differential. The snap-action thermostat is recommended for applications where the ability of the thermostat itself to carry heavy electrical loads (20 to 35 amps) without a relay is more advantageous than the prevision temperature response (0.1° F.), but lower load carrying capacity typical of the slow make-and-break type of thermostat.

Either remote or direct installation type models are available. The local bulb unit is designed for use over an adjustable 50 to 300 F. range, while the remote unit is available in two ranges—50 to 250 F. and 150 to 550 F. Up to 25 feet of tubing can be furnished with the remote model.

Prices of both units will be in the $10 to $15 range depending on the model selected. For complete technical information on this new development, just . . .

Circle E5 on Postcard

Viscosity Measurement

The Cincinnati division of Bendix Aviation Corporation has announced im-

For more data on advertised products, use Readers' Service Cards, last page.

Low... ACCIDENT RECORD

due to REGULAR SAFETY MEETINGS

WE QUOTE FROM A POLICYHOLDER'S LETTER

"We are pleased to acknowledge receipt of our dividend check in the amount of $4,682.06, which, with our Guaranteed Cost Discount, equals a 49.22% savings on our Workmen's Compensation Insurance.

"The service rendered by your office, and particularly the engineering and claims staff, has been most helpful in bringing about this reduction in our insurance costs. This type of service is unique with your company, and we are glad to pass this good word along so that other employers may benefit as we have. We can also attribute the low accident record to our regular meetings with our employees. At each of these meetings, we impress the importance of being careful and watching out for hazards and danger spots in the plant.

"The Texas Employers' Insurance Association have proven to our satisfaction that they can and do reduce insurance cost."

What **POLICYHOLDERS** *Say*

This is one of many testimonial letters received from policyholders of the Texas Employers Insurance Association. These letters tell what policyholders think of the Service and Savings received from the Association.

Ask the Texas Employers representative nearest you to show you more of these letters, as proof of what Texas' largest writer of Workmen's Compensation Insurance can do for you.

40TH ANNIVERSARY 1914 1954

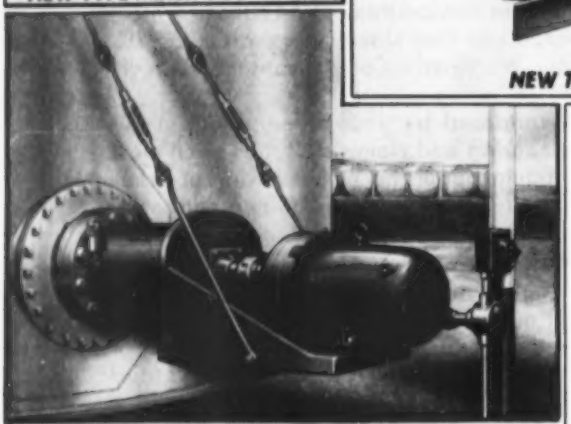
Largest Writer of WORKMEN'S COMPENSATION INSURANCE *in Texas*

TEXAS EMPLOYERS INSURANCE ASSOCIATION
HOME OFFICE · DALLAS, TEXAS

Service Offices: ABILENE • AMARILLO • AUSTIN • BEAUMONT • CORPUS CHRISTI • DALLAS • EL PASO FORT WORTH • FREEPORT • GALVESTON • HARLINGEN • HOUSTON • LUBBOCK • MIDLAND ODESSA • PORT ARTHUR • SAN ANGELO • SAN ANTONIO • SHERMAN • TYLER • WACO • WICHITA FALLS

For more data on advertised products, use Readers' Service Cards, last page.

LOOK TO "International" for Leadership in DESIGN and PERFORMANCE



Special Bulletins available on request
PUT YOUR PROCESSING PROBLEMS UP TO

INTERNATIONAL ENGINEERING, INC.
DAYTON 1, OHIO

NEW YORK—15 PARK ROW—WOrth 2-2580
CHICAGO—407 S. DEARBORN—WAbash 2-0733
TULSA—W. C. MEYERS CO.—WRIGHT BUILDING

New Equipment . . .

portant advancements in its new viscosity measuring instrument, the Bendix Ultra-Viscoson. This instrument, utilizing ultrasonic principles, is now offered in a complete line of indicating, recording and control systems which features a new approach to process control through viscosity.

A few of the applications of this novel viscosity measuring instrument are:

- Fuel Oil Blending
- Lube Oil Fractionation
- Asphalt Oxidation
- Asphalt Cutback

Complete technical details on this unique measuring device are available now. Simply . . .

Circle E6 on Postcard

P. V. C. Valves

Hills-McCanna Company has added to its Saunders Patent diaphram valve line valves with bodies of polyvinyl chloride. Coupled with the unique design of these valves, P. V. C. further expands the very extensive list of corrosive materials that can be handled successfully.

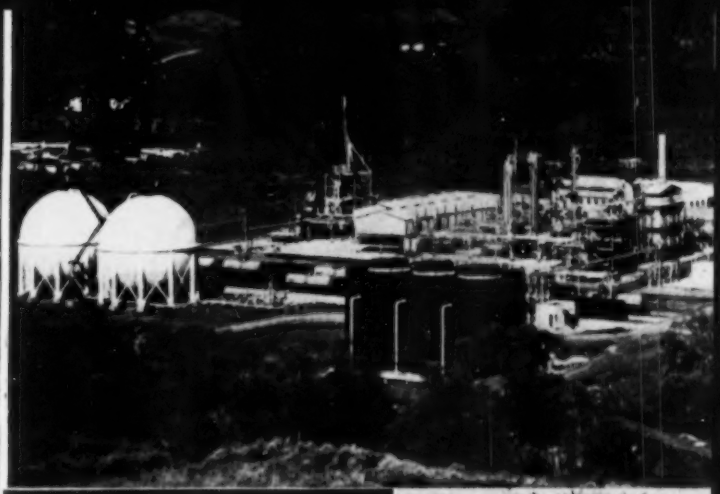
Hand-wheel operated, lever operated, sliding stem and air operated types are available in sizes from ½ inch through 2 inches. Screwed ends are standard and slip fits are available on special order.

This item supplements Hills-McCanna Company data on page 480 of The Refinery Catalog, 21st Edition.

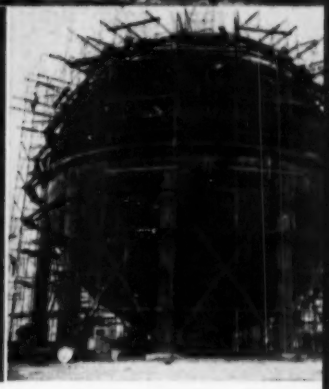
Circle E7 on Postcard

Communication Equipment

Explosion-proof inter-communication equipment for hazardous industrial areas is now available from Executone, Inc. This equipment comes with explosion-proof or dust-tight Condulet switches and is designed for installation at hazardous production areas where the pres-



At left workman applies lightweight FOAMGLAS easily and quickly. At lower right is shown the sphere during installation of FOAMGLAS. Above is Shell's Ventura plant. The two spheres are insulated with FOAMGLAS.



FOAMGLAS stay-dry insulation helps SHELL keep ammonia a constant 39°

Temporary storage of 3 million gallons of anhydrous ammonia in three huge refrigerated spheres is strictly routine now at Shell Chemical Corporation's new plants at Ventura and Kerman, California, thanks to the use of FOAMGLAS to insulate the million gallon spheres.

Two years ago Shell Chemical invested $10,000,000 in this new plant. Its product is pure ammonia which is handled as a liquid and kept in that state by storing it at a pressure of 50 psi and by refrigerating it to 39° F. For this purpose Shell erected two 65 ft. diameter spheres at Ventura and one at nearby Kerman.

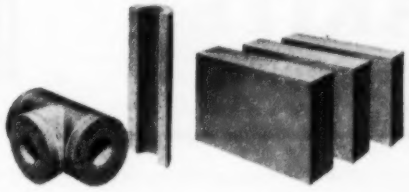
Keeping ammonia constantly at 39° F. calls for good insulation of the spheres. One of the reasons FOAMGLAS was selected for the job is that it stays dry. No other insulation has waterproof, sealed glass cells to provide constant insulating efficiency and protection of the spheres from corrosion.

FOAMGLAS has other unique properties too. It's fireproof, acid-proof and unaffected by contact with ammonia . . . further reasons why cellular glass was chosen to insulate all of the other refrigerated equipment and piping throughout these plants.

You will really profit when you insulate with FOAMGLAS. For the full story, send today for a sample and our booklet describing the use of FOAMGLAS to insulate piping, tanks and other equipment.

PITTSBURGH CORNING CORPORATION
Dept. Z-104 • One Gateway Center • Pittsburgh 22, Pa.

FOAMGLAS®
the cellular, stay-dry insulation

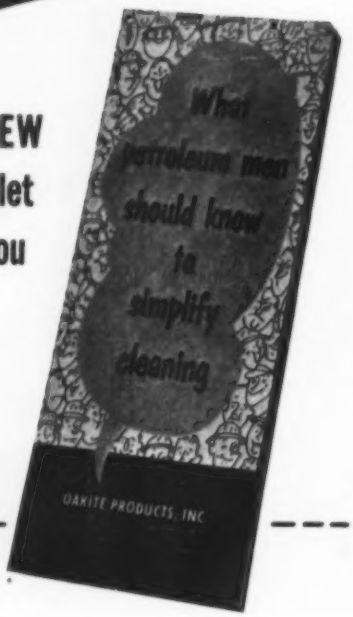


PITTSBURGH PC CORNING

Pittsburgh Corning also makes PC Glass Blocks

ONE IDEA

from this NEW Oakite Booklet may save you many a cleaning dollar



Here, in 48 fact-filled pages, you'll find helpful information on job-tested cleaning methods covering a wide range of maintenance, overhaul and repair work in all divisions of the petroleum industry. Just one idea may save you many a cleaning dollar on such jobs as:

- **Descaling heat exchangers**
- **Cleaning filter screens**
- **Washing fuel oil trucks**
- **Salvage cleaning**
- **Steam-detergent cleaning**
- **Paint stripping drums, barrels, storage tanks**
- **Cleaning tank car interiors**
- **Cleaning stabilizing, fractionating, absorption towers**

Illustrated booklet yours FREE for the asking. Send for your copy TODAY. Oakite Products, Inc., 50B Rector Street, New York 6, New York.

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. & Canada

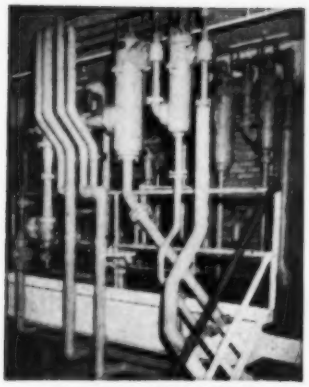


Photo Courtesy of
Hoffmann-LaRoche, Inc., Nutley, N. J.

LET C-R EVACTOR UNITS help improve your health

This illustration shows two 4-stage EVACTOR units in the plant of a leading manufacturer of vitamins and other pharmaceuticals. The same plant uses numerous other C-R EVACTOR units of different types—as do the majority of manufacturers in this important field—for many different processes, including deodorizing, distilling, drying, refrigeration, etc. They are as simple as the valves that turn them on, yet maintain absolute pressures down to a small fraction of 1 m.m. absolute where steady, dependable vacuum is extremely important.

This steady, dependable vacuum is contributing to the improved health of our population by helping to supply purer and more potent vitamins, antibiotics and other pharmaceutical products. It is contributing indirectly to the health of many operators and executives in other manufacturing industries, by minimizing worry over vacuum problems. This also applies to Jet Mixers, Jet Heaters, Jet Absorbers, Jet Scrubbers, Jet Pumps, Jet Condensers and Barometric Condensers.

CROLL-REYNOLDS

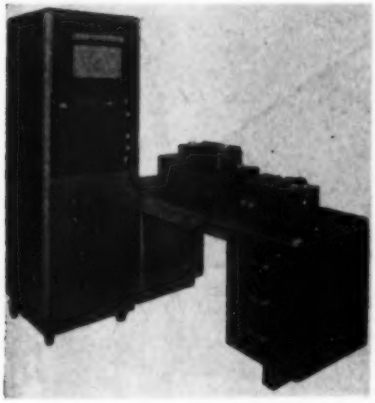
Croll-Reynolds CO., INC.

Main Office: 751 Central Avenue, Westfield, N. J.
New York Office: 17 John St., New York 38, N. Y.
CHILL-VACTOR UNITS • EVACTOR STEAM JETS • CONDENSING EQUIPMENT

ence of either flammable gases or vapors or combustible dusts prevents the use of ordinary inter-communication equipment.

Full details are available on this new line of inter-communication equipment now. Just . . .

Circle E8 on Postcard



Spectrophotometer

Beckman division of Beckman Instruments, Inc., has announced a new ultraviolet, near-infrared spectrophotometer. This new, commercially available instrument is designed specifically for the near-infrared region of the spectrum and fills an important gap in spectrochemical analysis. It lead sulfide detector and quartz monochromator permit high-speed transmission recording at cost and performance unmatched by conventional infrared instruments. The new instrument uses a photomultiplier detector for ultraviolet work and offers a guaranteed wave length range of 220 to 2700 mu.

The new unit provides a stability of double beam operation with a single receiver, and the fast chopping (480 times per second) takes full advantage of the sensitive lead sulfide detector. Resolution is 0.1 mu at 220 mu, 2.5 mu at 1000 mu; and 5 mu at 2500 mu. Any of five scanning speeds from 5, 15, 50, 150 or 500 minutes is seletctable for the entire range of 220 to 2700 mu. Stray light is less than 0.2 percent. A new technical bulletin describing this instrument is available now. Simply . . .

Circle E9 on Postcard

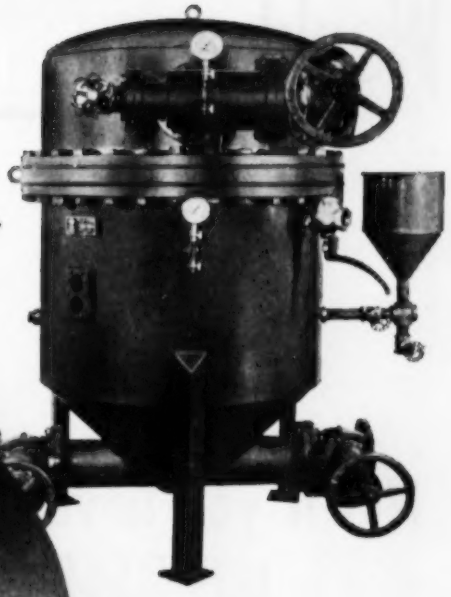
Induction Motors

New, re-rated, Tri-Clad "55" polyphase induction motors are now available in quantity in ratings from one to five h.p. according to a recent announcement by General Electric Company's Small Integral Motor department. Among the features of this new line of motors are:

- Greater horsepower and smaller space.
- Better production.
- Less noise.

NEMA frame sizes now available are

this small filter...



MAKES TOUGH JOBS EASY!

Stellar® *filter*

SMALL in size and operating cost, this Stellar Filter is BIG in results and efficiency. It saves up to 75% in space and up to 90% in weight. No coagulants are used. Operation may be by unskilled personnel.

The heart of the Stellar is the Air-Bump feature which keeps the Filter clean. No wasteful back washing is required for many applications.

Oil men are using the Stellar Filter for—

★ Filtration of water or brine for flooding, repressuring or disposal purposes.

★ Filtration of cooling water and recirculating process water.

★ Removal of ferrous sulphide and other impurities from monoethanolamine in natural gas purification.

INFILCO INC. *Tucson, Arizona*

INFILCO

Plants in Chicago and Joliet, Illinois

FIELD OFFICES IN 35 PRINCIPAL CITIES IN THE U. S., CANADA AND MEXICO

For more information on how the Stellar Filter can work for you, use coupon to the right.

INFILCO INC., P.O. Box 5033, Tucson, Arizona

Please send your illustrated Stellar Filter Bulletin No. 1560-Q.

NAME_____

TITLE_____

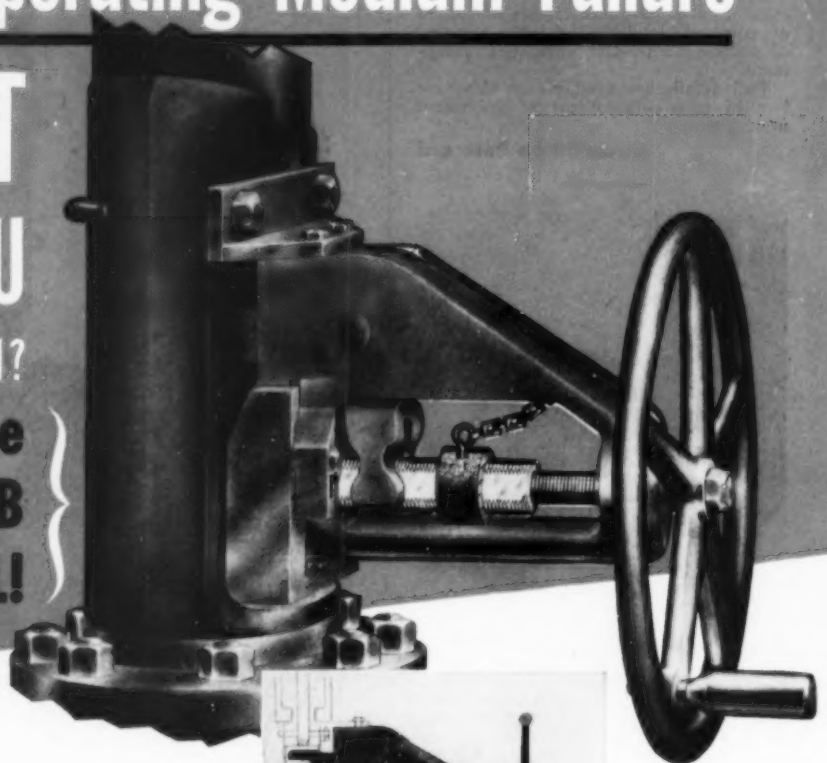
COMPANY_____

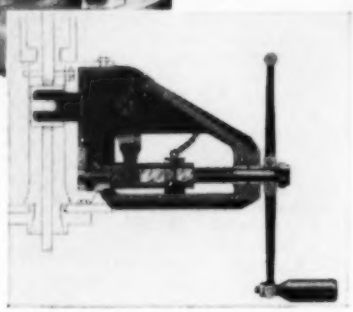
ADDRESS_____

CITY_____ STATE_____

Would an Operating Medium Failure SHUT YOU DOWN?

Not if you have this BS&B MANUAL CONTROL!





If the diaphragm control valves in your plant were suddenly rendered inoperative by failure of the operating medium, (or in rare instances by diaphragm failure within the valve), would you be forced to shut down immediately while repairs were made? Not if your valves are equipped with the BS&B Type Y Continuously Connected Side Handwheel for emergency manual control!

The Type Y is especially designed for use with all BS&B Diaphragm Control Valves, including Types 15 and 86, and the pressure balanced Type 73, where no by-pass is provided around the valve. It has a cast iron frame which fits onto the various Climax Valve Yokes. Working parts are of stainless steel, and it is equipped with an Ampcoloy jack screw, "Oilite" bearings and a large handwheel for ease of operation.

With the Type Y, control valves can be manually positioned in either direction independently of the normal controlling impulses. Its mechanism provides stops so that travel can be set to cover any portion of the complete valve stroke.

Avoid costly shut-downs due to operating medium or diaphragm failure! You can keep your plant operating indefinitely on an emergency basis if your control valves are equipped with the BS&B Type Y Continuously Connected Side Handwheel!

For complete information on any BS&B Climax Control or accessory, ask your BS&B Man, or write to . . .

CLIMAX BS&B CONTROLS OVER 60 YEARS

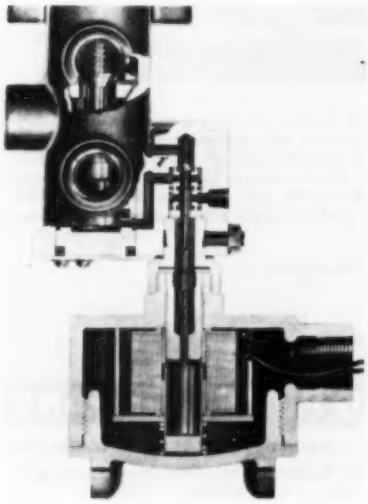
BLACK, SIVALLS & BRYSON, INC.
CLIMAX CONTROLS DIVISION, DEPT. 4-F10
7500 East 12th Street Kansas City 26, Missouri

New Equipment . . .

182, 184, 213, and 215. All ratings are available in totally-enclosed models as well as the regular drip-proof enclosure.

This item supplements General Electric Company data on pages 444-445 of The Refinery Catalog, 21st edition.

Circle E10 on Postcard



Solenoid Air Valves

Barksdale Valves Company is now making available to the refining, natural gasoline and petrochemical industries a new line of explosion proof solenoid air valves. Among of the many features of this new line of valves are:

- Extremely short solenoid stroke.
- Poppet design with linear sealing contact on resilient seats which makes both pilot and main valve self scavenging.
- The cover of the explosion proof housing is removable for quick access to the solenoid.
- The coils are interchangable.

For complete details on this new line of valves, simply . . .

Circle E11 on Postcard

Threading Kit

Beaver Pipe Tools is now marketing

Hose Replacement Reduced 1/3

with

Quaker

IRONSIDES STEAM HOSE

How to lessen hose replacement yet maintain production? That was the cost problem faced by a large chemical company—and solved by Ironsides' ability to give three times the service of other makes. Widely accepted as the strongest, safest hose for general steam service, Ironsides is braided with steel wire and bonded with rubber. Added braid of glass cord for insulation and extra strength. Kink-proof. Easy to handle. At least 4 times stronger than wrapped fabric hose yet costs no more. For economy, use Ironsides—a Quaker exclusive for greater service and safety.

Write for free folder and name of nearest distributor.

Belting, Hose, Packing and Moulded Rubber of every construction for every need.

QUAKER RUBBER CORPORATION
DIVISION OF H. K. PORTER COMPANY, INC.
OF PITTSBURGH

PHILADELPHIA 24, PA.
Branches in Principal Cities

For more data on advertised products, use Readers' Service Cards, last page.

scintillation counters for the oil industry

Tracerlab has a complete line of scintillation counters useful for solid and liquid sample assay, low level beta counting, aerial and ground surveying and many other applications. In addition, we supply packaged and unpackaged stilbene, NaI(T1) and ZnS crystals, plastic phosphors, and a wide range of liquid phosphors.

Please request Catalog DW, for complete specifications and prices.

Tracerlab inc.

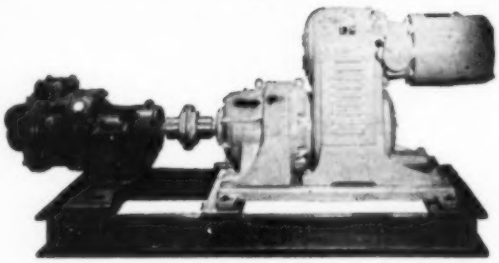
P-20
Scintillation Detector
for solid
sample assay.

P-20
Scintillation Detector
for liquid
sample assay.

P-12
Alpha Scintillation
Detector.

130 HIGH STREET, BOSTON 10, MASS.
2030 WRIGHT AVE., RICHMOND 3, CALIF.

An Interesting VIKING Unit



Viking Pumps are leaders in service to the Oil Industry . . . tops in performance and dependability.

Shown here is a versatile unit of the heavy-duty style designed to handle thin or viscous liquids. Capacity ranges from 10 GPM to 1050 GPM with pressure to 200 lbs. This unit shows totally enclosed vari-drive with a wide speed range.

We invite your inquiries—

Distributors

SOUTHERN ENGINE & PUMP COMPANY

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New Equipment . . .

a compact pipe and bolt threading kit for use by plumbers, pipe fitters, electricians and others. It provides storage space in a steel kit box for the threader and all basic dies and is lightweight and easy to carry or store.

The kit includes Beaver No. 71 Hand Threader, a set of ⅛-inch to ¾-inch pipe dies, a set of ¼-inch to 1-inch bolt dies, and a Beaver No. 71-R ratchet. All dies are furnished by eighths. Bolts dies are U. S. Standard, right or left hand, or S. A. E. right hand.

Additional information on this new kit is available now.

This item supplements Beaver Pipe Tools Inc., data on pages 170-171 of The Refinery Catalog, 21st Edition.

Circle E12 on Postcard

Lighting Fixtures

Of major interest to the refining industry in view of its increasing use of hydrogen is the recent development by Safe Lighting, Inc., of a new explosion-proof lighting unit which is approved by the Underwriters' Laboratories for use in hydrogen areas. These units operate with a self-contained air pressure which eliminates all breathing and seepage of gases which can cause interior explosions. About 11 psi is inserted which builds up to 15 psi under temperature. If, due to some unforeseen accident, the unit is damaged and loses pressure, its switches are set to extinguish the unit at 3½ psi. A relief device prevents the re-insertion of more than 25 psi. Units are delivered fully pressurized ready for mounting.

For complete information on this new development in lighting, simply . . .

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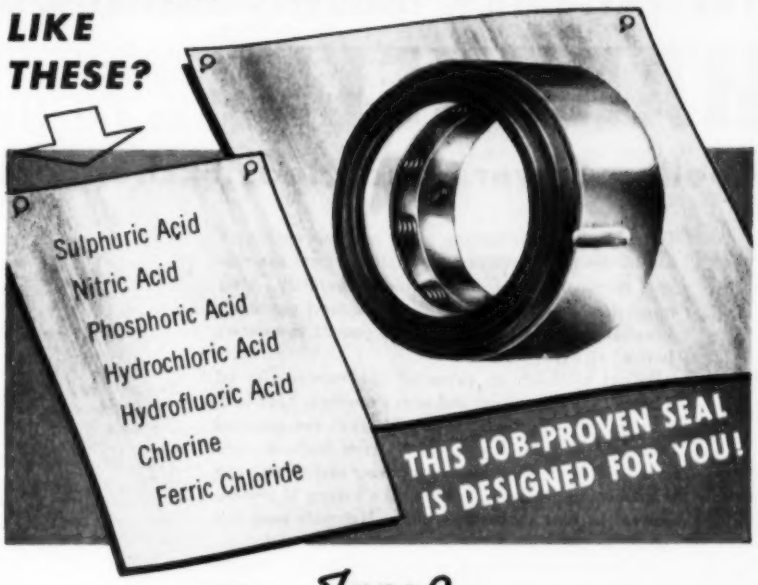
HANDLING CORROSIVES LIKE THESE?



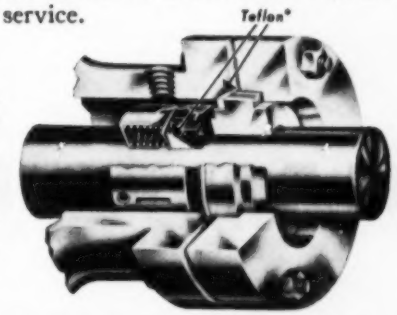
JOHN CRANE

Type 9

MECHANICAL SEAL

Performance records plainly prove that this "John Crane" development has successfully solved the handling of the most difficult corrosive liquids and gases. Where conventional type seals had failed, the Type 9 has done the job. It continues to answer new problems, including temperature conditions from —120°F. up to 500°F.

Designed to withstand practically all chemicals, the Type 9 incorporates a flexible wedge ring and sealing ring molded from DuPont's Teflon. It is engineered for the particular application and can be furnished in the metallurgical specification best suited to the service.



Your toughest problem can be the Type 9's next success story. Use it on all rotating shaft applications, including: centrifugal, rotary pumps, mixers, agitators, autoclaves, other equipment.

Get complete information on the Type 9 Seal from Crane Packing Co. 1820 Cuyler Ave., Chicago 13, Ill.

In Canada: ***Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.***

** Du Pont trademark*

JOHN CRANE CRANE PACKING COMPANY

For more data on advertised products, use Readers' Service Cards, last page.

The Petroleum Industry Insists On

HARTZELL Fans for Its

Cooling Towers and Heat Exchangers

Hartzite plastic for cooling tower and heat exchanger fan blades was developed especially to meet the rugged requirements of the petroleum industry. After more than ten years of service in the most punishing installations, Hartzite blades have proved themselves beyond all expectations.

What evidence is there of the superiority of Hartzell cooling tower and heat exchanger fans with Hartzite blades? Nearly every Hartzell fan installed since the introduction of the Hartzite blade in 1941 is still in service. And in nearly every case, where one Hartzell fan has been installed on a battery of cooling towers or heat exchangers, more Hartzells have followed as other blades needed replacement.

Fabric-base Hartzite absorbs vibration. Its strength is many times that necessary to withstand normal stresses. Its unusual resistance to corrosion and abrasion is constant throughout the blade. Hubs are of welded steel with an extremely high safety factor.

These are the reasons why Hartzell has become "the" cooling tower and heat exchanger fan in the petroleum industry.

For the complete story, send for Bulletin 1503.

HARTZELL propeller fan co.

Div. of Castle Hills Corp.

Name _____

Company _____

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ENGINEERING OFFICES IN PRINCIPAL CITIES

What's New in Manufacturers' Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card. Requests are transmitted to the manufacturer as soon as received by us for mailing of desired information directly to you.

Gage Catalogue

Jerguson Gage & Valve Company has just issued a new catalog which covers practically the complete Jerguson line of liquid gages and valves with a condensed presentation of the most pertinent data and specifications. This condensed catalog, an easy-to-use working tool contains valuable information for the engineer. Included are illustrations of the various standard and special function Jerguson gages and valves, description of features and uses, materials used, steam ratings of gages, dimensional drawings, and a full page table giving standard and optional construction features and specifications of Jerguson valves. To receive your copy, just .

Circle E14 on Postcard

Fire Control Bulletin

Inferno Company has just issued a new bulletin and price list on its complete line of firing controls and firing control parts. This bulletin describes the company's complete line of firing controls as well as listing the advantages of automatic control and showing the principle of operation of their units. To receive your copy of this most informative bulletin, simply .

Circle E15 on Postcard

Glossary of Terms

International Nickel Company has just published a "Glossary of Terms for Producers and Users of Iron Castings." This 36-page, pocket-sized book explains over 150 technical terms that are used in common between suppliers and users of both ferrous and nonferrous castings. The book should prove useful to the designer, machinist and purchaser of castings, as well as to the man in the foundry, and is offered to increase mutual understanding that promotes greater accord in working out the procurement of satisfactory and improved castings. Your copy is available now, just . . .

Circle E16 on Postcard

Chemical Feed System

Bulletin 1253 which describes controlled volume pumps and process instrumentation has recently been released by Milton Roy Company. This 20-page illustrated booklet gives complete description on Milton Roy's complete line of control volume pumps and includes a pictorial diagram section which explains the operation of these pumps.

Also included is an excellent "applications" section which illustrates by pictorial diagrams chemical feed system, open loop systems, closed loop systems, composite systems, special systems, and integrated systems. Various specific applications of these different systems are also given. In addition there is an engineering data section which is presented in a problem-solution form and which should be very useful in helping you with your applications of control volume pumps.

Your copy of this most informative booklet is available now. Simply . . .

Circle E17 on Postcard

Stainless Threading

An informative folder, "Helpful Hints on Hand Threading Stainless Steel Pipe and Tubing," which should be of interest to those confronted with the task of hand threading stainless steel pipe, has just been published by the Tubular Products division of Babcock & Wilcox Company. Containing a complete discussion on die stock, dies, speed, cutting oils and the assembly of threaded joints, it is intended to assist pipe fitters to obtain satisfactory results when threading stainless tubular products with hand tools on job sites or in provisional field shops away from machine threading facilities.

Copies of this new and informative folder are available now. Simply . . .

Circle E18 on Postcard

pH Bulletin

A new bulletin on complete instrumentation for pH measurement and automatic control has just been published by The Bristol Company. It contains drawings and photos of installations of pH recording and controlling instruments on such processes as alkylation, measurements of corrosion conditions in industry, as well as other applications in the refining, natural gasoline and petrochemical industries. Also covered in the bulletin are neutralization, extraction, and precipitation.

The bulletin features complete pH systems, including the electrode assemblies, amplifier and Electronic Cynamaster round or strip-chart records and controllers in both pneumatic or electric control actions.

Illustrated with 100 photos and detail line drawings, the 38-page bulletin Q1304 is available now. Simply . . .

Circle E19 on Postcard

Engineering Handbook

A 76-page, illustrated multi-V-belt engineering handbook featuring a convenient guide to the design of standard and high capacity drives has just been published by the B. F. Goodrich Company Industrial Products division. Copies are available without charge upon receipt of requests on company letterhead.

New horsepower rating tables closely approximate actual operating conditions and reflect the increased ability of modern belts. The tables cover speed ratings from 100 to 6000 feet per minute.

Other subjects covered in the new handbook includes: selection of correct multi-V-drives, installation and care of V-belts, principles of V-belt design, selection of pre-engineered V-V drives, how to design a standard V-V drive not in pre-engineered tables, designing V-flat drives, and many other topics.

Requests for this handbook should be addressed to The B. F. Goodrich Company, Industrial Products Division, Department PR, Akron, Ohio.

Circle E20 on Postcard

Flange Selector

A revised edition of the flange and coupling selector designed by Nooter Corporation is now available to all engineering personnel. In easy-to-read slide rule form, it provides all the information contained in the earlier selector plus new and useful data.

Among the relevant facts listed by the flange size selector are: o. d. of flange, thickness, o. d. of raised face, number of holes, diameter of holes, diameter of bolts and bolt circle for series 15 and 30 flanges. Also, a convenient pipe standard table is incorporated on the selector showing nominal wall thicknesses for schedules 10 through 160 as well as nominal thicknesses and weights per foot for standard, extra heavy and double heavy pipe.

A copy of this handy flange and coupling selector may be had by addressing a request, on company letterhead, to Nooter Corporation, Department PR, 1400 S. Second Street, St. Louis 4, Mo.

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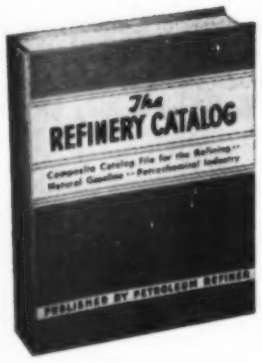

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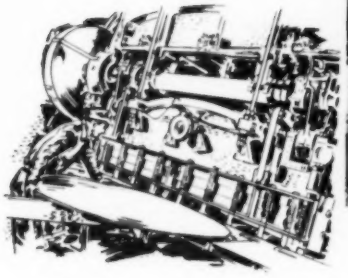

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McDONALD LINE STRAINERS

Advanced design — rugged construction for a full measure of dependability

TOP CLEAN-OUT STRAINERS WITH IRON BODY CAP AND YOKE, AND BRONZE STRAINER UNIT

PLATE 963 — Especially designed for quick, easy cleaning. Yoke is attached and lowered over body during cleaning process to eliminate the possibility of dropping or misplacement.

The strainer unit is bronze with a perforated brass cylinder. Strainer is available in 1/16", 1/8", 3/16" and 1/4" perforations. 1/16", standard for use with gasoline and kerosene, is furnished unless otherwise requested. 1/32" perforations can be furnished on request.

2" and 3" sizes available

PLATE 963-F—Design of strainer eliminates restriction. Identical in construction to Plate 963 except for flanged ends. 3" and 4" sizes available.

Strainer Unit and Top Cap. This type unit used in Plates 963 and 963-F. Furnished with female thread for attaching to male thread of cap, permitting removal of strainer unit from cap during cleaning if so desired.

BOTTOM CLEAN-OUT LINE STRAINERS

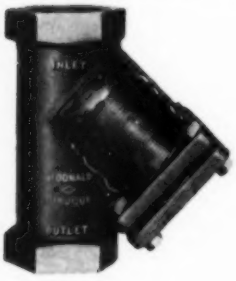

PLATE 914—Bolted Cap Type - cleaned by removing four bolts and lifting off the cap to which the strainer is attached. Furnished with iron body and perforated brass cylinder which acts as strainer. Strainer unit is heavily constructed to eliminate breakage. Perforated brass strainer is available in 1/16" (furnished unless otherwise specified), 1/8", 3/16" and 1/4" perforations.

Sizes 1½", 2", 2½" and 3"

PLATE 914-Y—Similar in construction to Plate 914 except for its cap and yoke design (see illustration). This type is preferred by many from a convenience standpoint. 2" and 3" sizes available

BELL STRAINER

PLATE 907—All bronze strainer used on end of suction when unloading tank cars. The McDonald Bell Strainer prevents sediment from being pumped into tank. Constructed with special rust-proof screen.

Sizes 2", 2½", and 3".

STRAINER CONNECTION

PLATE 806—Used when unloading tank cars from bottom outlet. Strains oil or gasoline before it passes through pump. Strainer is held firmly in place by a guide post on top cap. Removal of top cap removes strainer for cleaning.

Sizes 2", 2½", 3" and 4". Available in black or galvanized.

EST. 1856 McDonald

A. Y. McDONALD MFG. CO.

Dubuque, Iowa